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The

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Electric Power Supply.

ON Thursday last week the *Daily Mail* gave great prominence to what purported to be a forecast of the Government's intentions with regard to the future of electricity supply in this country; on examination it appeared that there was nothing new in the so-called "plan," except perhaps the statement that electricity bonds guaranteed by the Government to an ultimate total of £50,000,000 would be issued, to finance the scheme.

However, at the dinner of the Institution of Electrical Engineers that evening, Lt.-Col. W. Ashley, Minister of Transport, referred to the matter, and categorically stated that the Government, far from having any definite plans in view, was engaged in closely investigating the subject, and that no proposals would be put forward for its consideration until the most searching inquiries had been made from every source likely to afford useful advice.

On Saturday evening, at the dinner of the National Association of Supervising Electricians, Mr. A. Page was somewhat more explicit. Whilst repudiating the *Daily Mail's* theories, and declaring that electricity supply in Great Britain was to-day developing at a normal rate—15 or 16 per cent. per annum—with an average price of not 5d. but 2d. per kWh, he remarked that of the 550 generating stations scattered about the country some 350 should be shut down. The output would probably be doubled in five years and doubled again in ten, and in that period 200 or 300 million pounds should be expended on the supply side of the business alone. That outlay, said Mr. Page, must be applied more efficiently than in the past; parochialism and narrow-mindedness must go! Three points especially he emphasised: transmission had been neglected in this country and should be developel; standardisation of frequency must be accomplished now—or never; and the cost of distribution, inflated largely by our adherence to direct current, must be reduced. Greater use should be made of overhead lines, and if the wayleave question was an obstacle, it should be tackled to good purpose. All these matters, he said, were being thoroughly investigated by a very able committee; in

the meantime no credence should be given to any statements on the subject that might appear in the Press, whether technical or lay.

Mr. Page's reference to the imperative necessity of a network of mains about the country may be regarded as very significant, when taken in conjunction with previous hints dropped by the Commissioners with regard to interconnection and the standardisation of frequency. One of the chief reasons for demanding the latter is the difficulty of attaining the former without it; interlinking systems that work at different frequencies involves great expense, waste of energy, and reduction of the reliability factor. It is clear, therefore, that a great extension of cross-country mains is contemplated; in fact, Mr. Page remarked that if we had as good a network of transmission lines as existed in countries that were blessed with water-power, we should be able with our coal to supply electricity as cheaply as elsewhere. He explained that whereas cheap coal encouraged the multiplication of small local generating stations close to the points of consumption, the use of water power usually entailed the concentration of generation and the development of an extensive system of transmission lines, and to the latter circumstance he attributed the cheapness of electric power distributed from large hydroelectric stations.

This is a new point of view which deserves the closest attention. Hitherto, as Mr. Page pointed out, transmission has been neglected in this country. From time to time during the past 30 years proposals have been put forward for the erection of large stations on coalfields, with the object of economising in fuel transport and generating costs, but they have been condemned on the score of the long and costly transmission involved; now, we learn that the transmission system would not be an objectionable factor, but would actually be the most valuable feature of such a system!

Twenty years ago we had neither the large boilers and generating sets, nor the wayleave facilities, nor the co-operative spirit, all of which are essential to the success of centralised generation and decentralised distribution; to-day the situation is vastly different. It is recognised on all hands that local interests must give way to the imperative national demand for an abundant supply of electricity everywhere; the wayleave problem will not be allowed to block the path, and we have the big sets. Hence, if this is the way to our electrical salvation, the gate is open.

We are grateful to Mr. Page for lifting the curtain even so little, and we hope that his remarks may be exempted from the ban of disbelief which he has uttered, even though they are reported in a technical journal!

They run curiously parallel with an article by Mr. G. V. Twiss, M.I.E.E., which appeared in *The Times Trade and Engineering Supplement* on the same day, and which we abstract elsewhere in this issue. Mr. Twiss foreshadows a National Electricity Board to build and operate a network of main transmission lines throughout the country, buying energy in bulk from the manufacturers and selling it to the distributors. Whether the intervention of such a "middle-man" would be advantageous may be a fertile subject for argument.

It is clear that the matter is being investigated with broad and long views, and that being so, we shall be content to wait for the well-weighed scheme which, we understand, will be forthcoming in a few months' time.

Features of Wembley in 1925.

We have already published (Elec. Rev., January 9th, p. 42; January 16th, p. 88) comments on the intentions of the authorities respecting the principal features of the British Empire Exhibition at Wembley this year. The speeches then referred to have been supplemented by information since vouchsafed from other sources. It has been made plain that there will be no organised collective electrical and engineering exhibits, though a number of firms in this branch of British industry will make worthy displays; that there is not to be any collective display of motor-car exhibits, and individual exhibits are not to be encouraged by the motor traders' organisations; that the woollen industry is taking more space than in 1924; that the cotton industry will not exhibit; that the reviving furniture trades will be more prominently in evidence; that food exhibits will be more extensive; that domestic utility and labour-saving appliances will be an important feature; that the gas exhibit will be similar in appeal to that of 1924, but will occupy double the space; that there will be more working exhibits in the Palace of Industry and fewer dead ones; that housing exhibits and transportation equipment will have a large place in the Palace of Engineering, where there will be specially added restaurant accommodation. The roads which were responsible for so many soothing words last year have been attended to during the winter, and if the elements smile more and weep less they should be in a better condition. Of the entertainments, amusements, catering arrangements, and the added attractions of the gardens, we need hardly speak.

The objects of this year's effort are, briefly summarised, these:—To continue the work of Empire education; to demonstrate to the people at Home the resources of the Empire; to develop the raw materials of the Empire; to foster inter-Imperial trade; to bring the various races of the Empire into closer touch; and to provide for six months a social centre for the Empire.

There will be various improvements indicating that the authorities have profited by the experience of last year. We are informed that much greater use will be made of illumination as a means of attracting visitors.

While there will be no large collective electrical engineering display such as made us all proud last year, electricity and electrical exhibits will have their place to fill in connection with the housing demonstrations, the labour-saving features, the working exhibits everywhere, and in many parts of the palaces of engineering and industry. It is probable that by the preparation of suitable exhibits in the department of domestic utilities a number of electrical companies will be able to make worthy and effective demonstrations of the exclusive place that electricity is now beginning to occupy in the affairs of our common family life by lightening its duties and rendering its conditions more hygienic.

The Exhibition authorities are planning to make the most of the national interest that centres round the problem of housing. The committee that is preparing this section is presided over by Mr. Neville Chamberlain, Minister of Health, and the B.E.A.M.A. will co-operate by giving certain advice in connection with the provision of electrical installation work for the exhibits, and its members may provide certain of the material and apparatus required. Too much importance, however, must not be attached to the circumstance that its director, Mr. D. N. Dunlop, is a member of the committee. Both the B.E.A.M.A. and the British Commercial Gas Association have promised their assistance, but as our readers are already aware the former, at any rate, has not undertaken any large responsibilities in connection with the Wembley exhibition of 1925.

Some Coming Exhibitions.

Manufacturers of machinery, apparatus and devices that are employed in the practical applications of electricity to industrial and domestic service will have several excellent opportunities for demonstrating their products at special exhibitions during the coming months. The leading event of the kind is, of course, the Ideal Home Exhibition, opening in London next month, and already fully referred to here. Another occasion, though of a somewhat different and purely trade character, is found in the British Industries Fair now in progress at Castle Bromwich, Birmingham. There is also the Nation's Food Exhibition taking place at Olympia in March and April and a Printing Trades Exhibition in London in May, while in the early autumn a purely electrical exhibition at Leicester is promised appealing largely to mining men

and those interested in industrial electrical installations. In October, at Manchester, there will be a Textile Trade Exhibition, which naturally will afford large scope for electrical engineering firms. These are all events for specialised demonstration effort rather than for exhibits of the "Everything Electrical" description, and exhibiting firms will exercise fitting discrimination and take their choice.

A fixture which should stand out as of particular interest during the summer is that to be held at Chester. What Chester and Mr. Britton have done for the cause of electricity in agriculture is common knowledge amongst our readers. Therefore when it is mentioned that the Royal Agricultural Show—the great event of the year for the farming fraternity—is to be held in Chester, it will be at once agreed that there could be no finer and more appropriate opportunity for a strong demonstration of the gathering force of the electro-agricultural movement and of the readiness of electrical manufacturers and contractors to make an effective and educative appeal right in the heart of the agricultural industry. Mr. Britton's Electricity Department at Chester has issued a communication setting forth some details of the event for electrical consideration. It is pointed out that for some years past certain Government Departments, electricity supply authorities and Associations and others, have urged the use of electricity in agriculture and rural industries, and have repeatedly referred to the great developments in the use of electricity for such purposes on the Continent and in America, Canada, Australia, New Zealand, and other countries. He points to the attempts that are now being made in this country to serve the agricultural districts with electricity, and suggests that the Royal Agricultural Show is the most appropriate place to demonstrate the utility of electricity. The Chester Corporation Electricity Committee has discussed the matter with the interested Committees and Council of the Royal Agricultural Society, and approval has been given to the proposal of the Corporation to supply electricity and make the necessary installations free of cost to exhibitors for use in connection with their exhibits. The Show takes place from July 7th to 11th inclusive, and electrical firms who think of taking advantage of this excellent opportunity of becoming known in a new and important field should communicate their desires and requirements (the supply is 420 volts and 210 volts direct current) to Mr. S. E. Britton, the city electrical engineer, as soon as possible, so that they may receive the consideration of his committee and of the Royal Agricultural Society.

Radio Legislation.

GREAT interest has been aroused by the printing of the Postmaster-General's Wireless Telegraph Bill, some of the provisions of which will meet with strenuous opposition. Many of the clauses are not actually new, being transferred with slight alterations from the Act of 1904, which is to be repealed; but the opportunity will be seized to press for their amendment.

That everyone who makes use of the entertainments broadcast by the B.B.C. under the ægis of the Postmaster-General should be made to pay for the service we cordially agree; but the maximum penalties provided for the failure to do so are out of all proportion to the magnitude of the offence. That stringent penalties should be provided to deal with unlicensed transmitters, however, seems reasonable; for them we have no sympathy.

Other clauses which we should like to see modified are those which relate to the experimental class of licensees; excellent work has undoubtedly been done by these enthusiastic amateurs, and whilst a certain amount of control of their doings may be necessary, in our view they should be given as much freedom as possible. No Post Office official should be in a position to pass judgment upon a programme of experiment. On the other hand, it is not unreasonable to require satisfactory evidence that the experimenter himself possesses the technical knowledge and skill necessary to the intelligent prosecution of radio research, and this might take the form of certificates signed by responsible persons. Much of the criticism which has been levelled at the Bill in the daily Press is obviously based upon misapprehension of the situation and ignorance of the existing law; in a later issue, therefore, we hope to publish a critical review of the subject and to indicate the true bearing of the new provisions.

Broadly speaking, we regard it as the duty of the Post Office to foster the development of radio-telephony in this country as effectively as possible, and by no means to retard its evolution by a tangle of regulations and restrictions.

The Protection of Cables from Moisture.

THE importance of the sealing of cable ends, particularly in the case of cables used in factory installations, &c., is probably very much underestimated. It would be well to remember that if moisture is once permitted to enter the end of a cable between the conductor strands and the insulation, or between the strands themselves, it will travel along the conductors very rapidly, and with disastrous results. The absorption of moisture by the insulation, particularly in the case of paper-insulated cables, must also be considered in dealing with this question, and the only way to prevent the damp from getting in is, obviously, to render the area external to the conductors and internal to the sheathing of the cable water-tight.

A case reported to us recently, of a fault developing on a cab-tire-sheathed cable, in which no attempt at sealing the ends had been made, rather suggests that the view may be held that in the case of rubber-insulated cables the rubber is adhesive to the copper, thus rendering a sealed end unnecessary. This is far from being the case, and the necessity of dealing with the ends of all cables used in factory installations, &c., as strictly as we deal with the ends of underground cables, cannot be too forcibly emphasised.

For a comparison of the methods of sealing the ends of cables, it is convenient to divide cables into two classes, one comprising underground types of cable, usually paper-insulated and lead-covered, and the other the ordinary types of rubber-insulated cables used in installation work.

In the latter case, apart from the use of sealing chambers, the method of applying a warm compound stick to the wires at the point where the insulation is severed, first individually with the wires unstranded and again over the whole with the wires restranded, and then taping over the compound, is undoubtedly the only really effective one. This method was dealt with in detail in our issue of April 13th, 1923, in an article entitled: "One Reason For Faults in Wiring Work," by Mr. K. F. Bishop, and was again illustrated in our issue of April 18th, 1924. The practice of taping the ends of cables is useless, and merely amounts to extending the insulation; indeed, with a poor selection of tape, matters may be made much worse.

The sealing of the first type of cables is usually effected by means of a sealing chamber in the form of a porcelain or cast-iron box, a suitable gland making a water-tight joint over the cable sheath at the inlet, and the outlet being simply a hole in the box large enough to give ample clearance between the box and the bare copper, the box being completely filled with hot compound. Fuse boxes fitted with sealing chambers and trifurcating boxes, &c., are good examples of sealing methods.

It is equally important, of course, that the ends of cables not in use should be sealed; this is a rather simple matter, as the copper can be cut through level with the insulation and the whole end sealed over.

E

The Ringwood Hydro-Electric Station.

The Utilisation of a Low Head Water-Fall on the Avon.

THE Ringwood hydro-electric station, the opening of which we referred to in our issue of February 6th, is of particular interest, first, because of the attention at present given to the subject of water power in this country, secondly because it is believed to be unique, in that it is working on a fall of only 4 ft. of water, and thirdly because it is the result of great local enterprise. The company promoters and directors are local residents, the capital has been raised locally, and the water turbines employed have been made by a local firm, Messrs. J. Armfield and Co., Ltd.

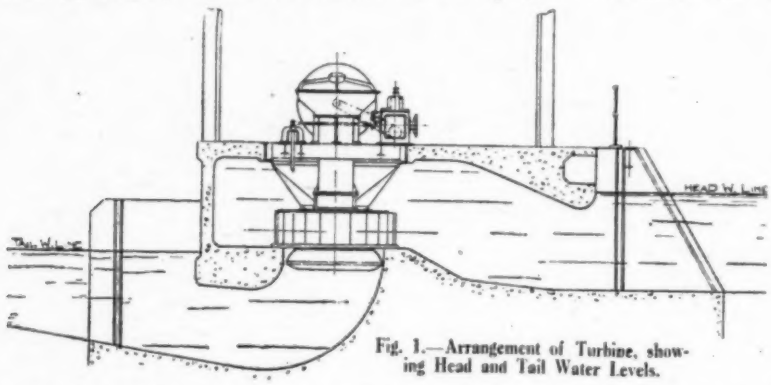


Fig. 1.—Arrangement of Turbine, showing Head and Tail Water Levels.

Although the head of water is small, water shortage is not probable, and it is estimated that the average available flow is 26,000 cu. ft. per min.; the water is distributed over a large area of channels.

The station is erected next to a mill where the waterfall has been utilised for many years past, and an agreement has been made between the Supply Co. and the mill owners, providing a working arrangement satisfactory to both parties in the event of a water shortage preventing both undertakings from running at full load simultaneously.

Two 50-h.p. turbines have been installed, and are at present working on foundations which, owing to the low fall, had to be sunk 14 ft. below the head water. Considerable difficulties were met with during these operations, and matters were not helped by the wet weather. The bulk of the water was diverted during operations by means of piling, and leakage was dealt with by pumping. The actual costs, however, have not materially exceeded the sum provided.

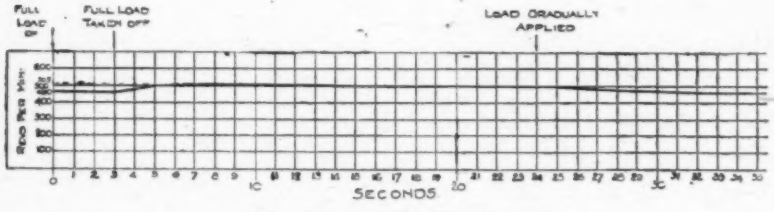


Fig. 3.—Speed Chart of one Turbine.

The two machines are identical in every respect, and fig. 1. an outline sketch of the water arrangements of one of the turbines, shows the head and tail water levels and the water path through the turbine wheel.

The turbines are vertically placed and rotate at 76 r.p.m. The vertical shaft of each is coupled through spur gearing to a shaft carrying a 45-kVA a.c. generator and an exciter, the horizontal speed being increased to 500 r.p.m.

Fig. 2 represents the general arrangement of each complete machine, including turbine, alternator and exciter. The turbine is shown in section, affording a clear conception of its arrangement. The vertical shaft is entirely held and supported by the cylindrical trunk, the bearings are ingeniously arranged, and it will be noted that special packing precautions have been taken at the lower gland.

The machines are rendered self-regulating within a 3 per cent. speed limit between no load and full load by means of oil-pressure governors. Fig. 3 is a speed chart taken from one of the machines, showing the speed variations between no load and full load; it will be observed that the speeds are taken from the horizontal shafting.

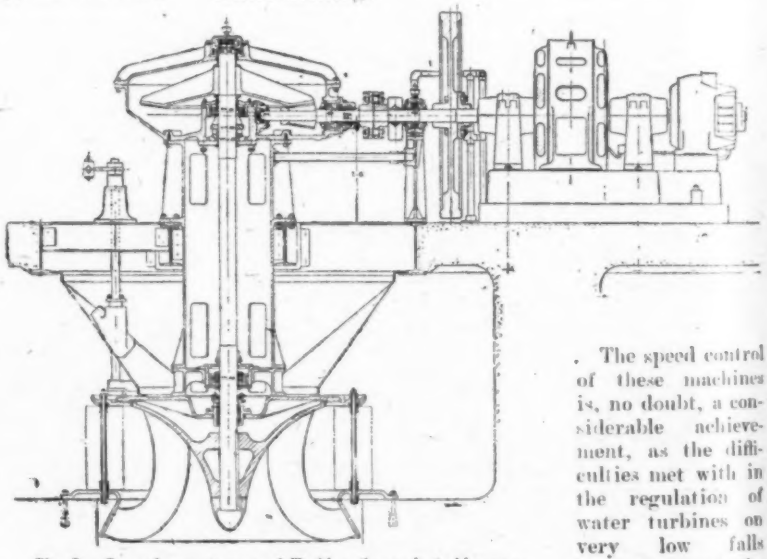


Fig. 2.—General arrangement of Turbine (in section) Alternator and Exciter.

The speed control of these machines is, no doubt, a considerable achievement, as the difficulties met with in the regulation of water turbines on very low falls have rendered the utilisation of such falls for electric generation in the past almost impossible.

The principle of the oil-pressure governor lies in the opening and closing of the turbine blades by the directional flow of oil—under pressure from a pump—controlled by the reciprocating movement of an ordinary acceleration governor through an arrangement of slide valves. The drive for the governor is taken from the generator shaft. Connecting links between the turbine vanes are arranged with couplings, screwed with reverse threads at each end, to take up wear in the links.

Fig. 4, a section of the oil pressure governor, shows the acceleration governor and the slide valve arrangements controlling the path of the oil. The oil is kept in constant circulation by a pump on the pulley shaft, fig. 4, and is forced up the sloped connection to the control valve at the top. The governor is driven by worm gearing at about 1,600

r.p.m., and contains spring-controlled pendulum weights which lift a pilot valve within the main cylindrical valve when the speed is increased. The oil which normally circulates through the valve passages is passed to the under side of the main valve, which is thus raised, the parts are uncovered, and the oil passes to the piston controlling the gate gear, fig. 5. When the piston is moved, the main valve sleeve is also moved, re-covering the admission parts and reopening the flow-

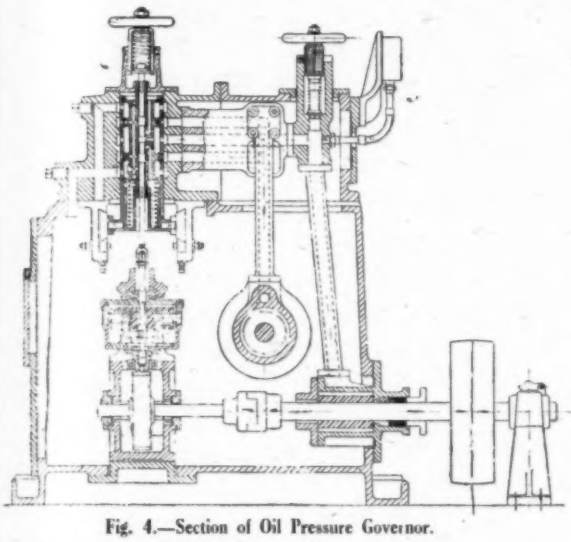


Fig. 4.—Section of Oil Pressure Governor.

through passages, so that the piston movement is checked. The extent of the piston movement depends upon the slant of the compensating sleeve guides and the variation of speed from the normal. The pilot valve is very light, and the pendulum is given very little work to perform. At the end of the stroke the admission

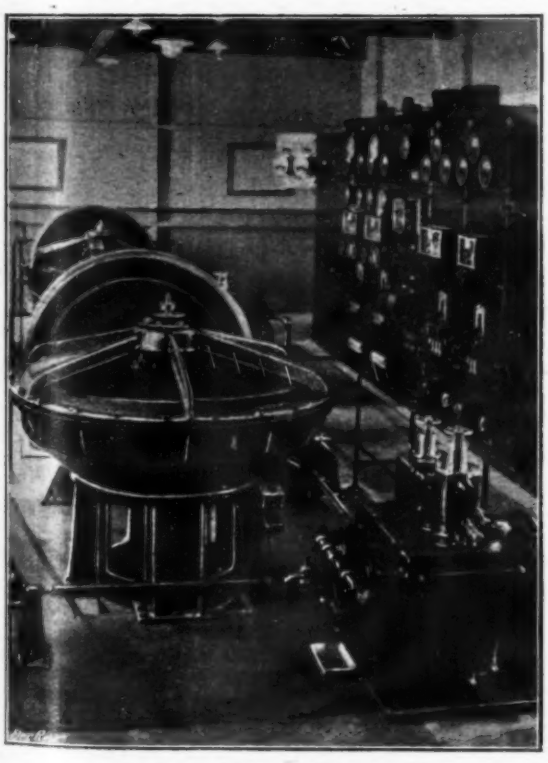


Fig. 6.—General View of Turbine Room.

parts being closed, only "flow-through" pressure being maintained on the piston, so that there is no further rise of pressure for the pump to work against. Fig. 5 shows a section of the oil cylinder with the oil paths to the "up" and "down" sides of the piston carrying the spindle controlling the opening and closing of the turbine blades. It will be noticed that the spindle can be operated by hand by means of the hand wheel carried on the thread at the end of the spindle. This is used for stopping and starting.

The alternators, which with the exciters and the main switchboard were supplied by the General Electric Co., Ltd., generate 3-phase at 50 cycles and 400 V between phases, as stipulated by the Electricity Commissioners in granting the application for permission to supply the outlying areas of Ringwood.

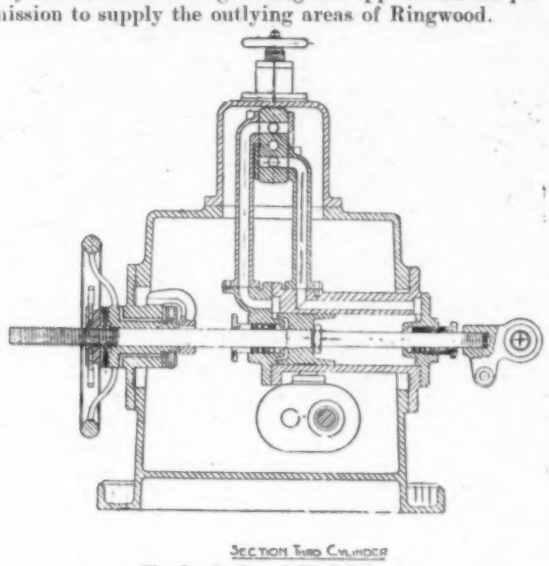


Fig. 5.—Section of Oil Cylinder.

The station switchboard is of the G.E.C. slate panel open type, fitted with overload relays and the usual measuring instruments and one automatic pressure regulating panel. Fig. 6 gives a good view of the near turbine and its governor and of the switchboard.

At present only the town of Ringwood is supplied, a 4-core cable transmitting from the switchboard direct at the pressure of generation to a central distribution pillar. Single-phase current is distributed from this pillar by twin cables, at 230 V between phase and neutral.

Provision is made for h.p. overhead transmission to the outlying districts at a later date, when step-up and step-down transformers will be used; a transformer panel is reserved for this purpose on the switchboard.

The whole of the cables, which are 660-V, paper-insulated, lead-covered and armoured, have been supplied by Messrs. Johnson & Phillips, Ltd.

The total capital expenditure on the undertaking is £19,900, and the estimated annual expenditure is £2,350; while the estimated income is £3,523 per annum, based on lighting at 1s. per kWh, and heating and power at 4d. per kWh, with an estimated consumption of 23.3 kWh per head per annum. The population of Ringwood and the outlying districts is 7,100.

At the formal opening of the undertaking, Mr. Rooper, M.Inst.C.E., M.I.E.E., consulting engineer for the undertaking, said that on the Avon between Salisbury and the sea, seven water-falls were at work developing 545 h.p. There were nine falls not in use which could develop 1,750 h.p., and with all falls properly developed over 13 million h.p.-hours could be obtained per annum, the equivalent of 17,000 tons of coal.

Electric Locomotives for Swiss Federal Railway.—A contract has been placed by the Swiss Federal Railway authorities in Berne with the Société des Ateliers de Secheron, of Geneva, for two electric locomotives. They are intended for service on the Lotchberg railway and are required to maintain an average speed of 31¼ m.p.h. and to be able to haul a 560-ton train up the Frutigen-Kandersteg section, which has a gradient of 27 per cent. The engines will be fitted with six motors each working on the same axle and developing at the wheel tyres a total of 4,200 h.p. The machines, which have to be completed by the spring of 1926, will weigh a total of 135¼ tons. The overall length between the buffers will be 65 ft.

Contact Resistance of Brushes on Commutators.

By "ATOM."

CONTACT resistance is one of those small details which, if not carefully noted and checked from time to time, may cause quite appreciable and unnecessary losses, and it is therefore well worth while to spend a few minutes studying the effect of various factors upon it.

Contact resistance is generally to the fore in connection with commutation, where it plays a very important part, and it is in this connection that we will study the various factors affecting it.

As an example, consider the contact resistance between the brushes and commutator of an ordinary industrial motor: It must be remembered that the resistance of the brush and the contact resistance are two very different things, the former not giving any indication whatever of the value of the latter. The factors which materially affect brush contact resistance are: (1) current density, (2) composition of brush, (3) mechanical pressure on brush, and (4) speed of surfaces in contact, of which the first two are by far the most imporfant.

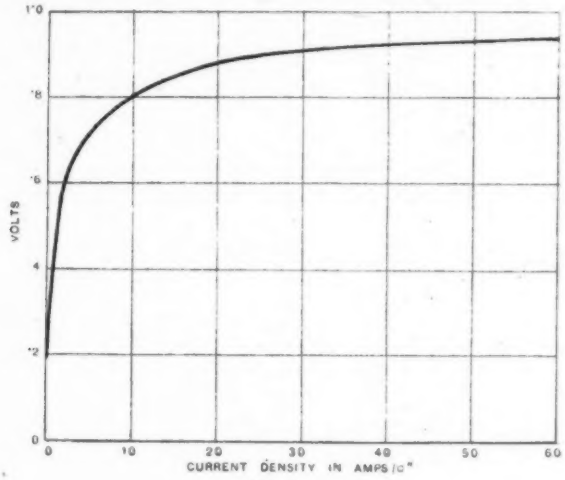


Fig. 1.

1.—Effect of Current Density.

The current density in modern, medium-sized, industrial motors usually falls somewhere within the range 20-100 amps. per sq. in. Between these values the contact drop is almost constant, and follows a curve similar to that shown in fig. 1. This is, of course, equivalent to saying that the contact resistance varies inversely as the current density, other conditions remaining normal; this variation is more clearly shown in fig. 2.

In connection with the case of a number of brushes working in parallel, it may be noted that if they are working at a current density, say, up to 15 or 20 amps. per sq. in., they are working on that part of the curve where a small alteration of current density causes a relatively large variation in the contact drop, *i.e.*, in this case the current density is one of the chief factors governing the contact drop. If, however, the brushes are being worked at a high current density, the curve shows that a large variation of current only has a very slight effect on the contact drop. This means that the contact drop in this instance is governed to a much greater extent by other factors than current density, not all of which lend themselves to calculation and control as the current does. The moral of all this is that if possible, brushes operating in parallel should be designed to work somewhere round the knee of the curve rather than at very high current densities.

Of course, the governing factor is the temperature rise. Heat is always generated when current flows across two surfaces in contact, and it is necessary to see that the surfaces are of sufficient area to carry the current. The value of current density which may be safely used without excessive temperature rise resulting is, for carbon brushes, up to about 40 amps. per sq. in.

2.—Composition of Brush.

This is, undoubtedly, the chief factor affecting the contact drop, as the manufacture of brushes to-day has reached a stage where almost any grade of brush imaginable can be supplied. The contact drop varies from about 1.5 volts with some of the carbon brushes down to as low as .2 volt with some of the copper-graphite types.

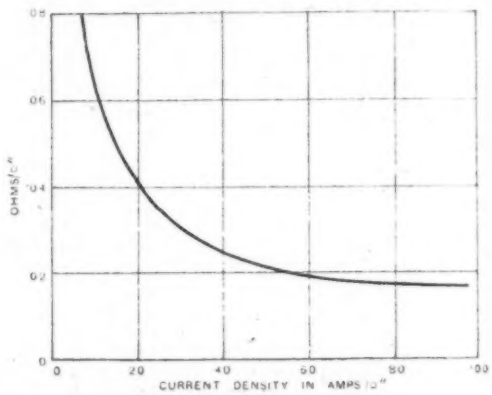


Fig. 2.

3.—Mechanical Pressure on Brush.

The effect of varying the mechanical pressure on a brush is well illustrated by fig. 3, from which it will be seen that the contact resistance is considerably decreased as the brush pressure is increased; at first rapidly, and then more and more slowly until when a pressure above 3 lb. per sq. in. is reached the decrease in drop is very small indeed—certainly too small to justify the increased mechanical friction which it occasions. Fig. 3 is based on tests made on an ordinary carbon brush.

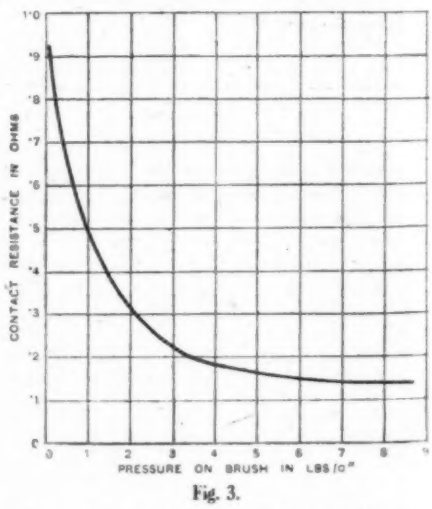


Fig. 3.

Where brushes are operating in parallel it should be remembered that any variation in pressure from brush to brush will cause a corresponding variation in contact drop and this fault should, therefore, always be guarded against.

4.—Speed of Surfaces in Contact.

The effect of the relative speed of the two surfaces in contact does not appear to be very pronounced between the limits of 1,500 and 3,000 ft. per minute, although, naturally, the state of the two surfaces must be normal; *i.e.*, the commutator must be free from pitting or bad spots, and also free from oil. It is, however, necessary to distinguish between the case of commutators and slip rings. The contact resistance in the latter instance is much less affected by varying speed than in the case of a commutator. The reason for this is that the commutator can never be made mathematically exact, and consequently although it may not appear so to the naked eye, the brushes are really in a state of continual vibration due to the rapidly alternating mica and copper surfaces which pass underneath them. As the peripheral speed of the commutator increases this vibration also increases, and consequently the contact resistance tends to increase. In the case of slip rings a constant condition is much more quickly reached, and if the rings have been accurately manufactured vibration does not develop to anything like the same extent. The above constitutes one of the reasons why commutator troubles are more liable to occur in small high-speed machines than in machines having large commutators but running at a lower speed.

The condition of the surfaces in contact, as indicated above, has considerable effect on the contact resistance. It is, of course, understood that any serious defects, such as flats, &c., will cause considerable increase in contact resistance. In addition, it may be noted that such an increase would also be caused by oxidation of the copper, whilst an oily surface, for more reasons than increase of contact resistance, should also be strictly avoided.

Altogether the contact resistance between brush and commutator is a very valuable aid in the operation of electrical machinery, and plays a very important part in the production of sparkless commutation. This is one of the points upon which carbon brushes show a great superiority over copper brushes. Naturally, there is the corresponding disadvantage that the contact resistance of the carbon brush is higher than that of the copper. In some cases this higher resistance may be important; consider, for instance, a carbon brush having a contact drop of two volts. Whilst this is negligible in machines designed to operate at high voltages, such a drop would form a large percentage in a low-voltage machine.

The National Association of Supervising Electricians.

Annual Dinner.

On Saturday last the annual dinner of the N.A.S.E. was held at the Holborn Restaurant, London, the President, Mr. Frank Gill, M.I.E.E., being in the chair. There was a large attendance of members and guests.

After the loyal toast, Mr. W. H. Patchell, President of the Institution of Mechanical Engineers, proposed "The Association." Referring to the great responsibility of the position that the members occupied, between master and man, he said they must all pull together and try to bring about a real brotherhood in the industry. They could do a great deal to popularise electricity and get a good load factor, which was essential to success. The Americans were using labour-saving devices to the utmost, and we must follow their example. The experience of the N.A.S.E. would be of great value in the revision of the I.E.E. Wiring Rules.

Responding, Mr. T. H. Windibank reviewed the position of the Association, and paid a cordial tribute to Mr. A. Brammer for his self-sacrificing work as secretary; they were twice as strong financially as they were a year ago. They had a national agreement with the contractors which made them staff members; also sick benefit, a very efficient employment bureau, and an active educational side. Mr. W. E. Highfield's shield competition had produced many excellent papers, and the scholarship scheme, also due to him, was a success. Mr. Frank Gill had allocated £75 for the endowment of premiums to be awarded annually for papers. He believed the electrical industry was on the verge of a great expansion, and there would be great opportunities before the Association.

The toast of "The Visitors" was proposed by Major T. Vincent Smith, M.C., M.I.E.E., who referred to the presence of Mr. A. Page, M.I.E.E.—one of the Electricity Commissioners—and other distinguished guests. In reply, Mr. Page said that the great institutions were prospering because they no longer confined themselves strictly to scientific work, but had enlarged the scope of their interests. There was a great responsibility resting on the electrical industry, which had to assist other industries. The work of the supply branch could not be done in the *Daily Mail* manner, but a plentiful supply of electricity must be provided, coupled with an active selling policy. Electricity supply in Great Britain was in a normal condition of development, increasing at the rate of 15 or 16 per cent. a year; the output was six thousand million kWh, and the maximum demand 2¼ million kW. Over 160 million pounds was invested in that side of the industry, and the average selling price was 2d. a unit—some undertakers averaged as low as 1d. There were 550 generating stations, of which 40 per cent. were below 1,000 kW, and 80 per cent. below 10,000 kW; they would probably have to do away with 350 of those stations. Within five years the output would probably be doubled, and in 10 years quadrupled; some 200 or 300 million pounds would be expended on the supply side alone in the next 10 years, and that money must be applied with higher efficiency than in the past. Parochialism and narrow-mindedness must go, and the Commissioners were striving to concentrate on large stations. Unfortunately, transmission in this country had not received the attention it deserved. If we had a body whose business it was to provide transmission, it would go a long way to help the industry. The Electricity Commissioners were endeavouring to promote bulk supply, but their hands were tied, so that progress was slow. Standardisation of frequency would assist them materially, but would be costly; however, if the present opportunity was lost it would be lost for ever. It was often said that water power enabled other nations to get ahead of us, but it was not the water that enabled them to supply cheap electricity for industrial purposes—it was because the sources of power were so far from the consumer that these concerns had been forced to provide a network of transmission lines, and if we had a similar network we could do quite as well with our coal. He emphasised the importance of distribution, which accounted for 60 per cent. of the average selling price; that was partly due to our love for direct current. We must reduce the cost and must abandon our old-fashioned ideas. We must also make more use of overhead lines; if the wayleave question was the obstacle, it must be tackled to real purpose. All these things were to-day being carefully investigated by a very able and influential committee. They should not believe anything they saw in the technical or lay Press until a really authentic announcement was made—which would not be this month.

Sir R. Burton Chadwick, M.P., proposed "The Press," and took occasion to compliment Mr. Windibank on the expression of his views with regard to the welfare of the worker, and his right to an adequate reward for work well done; Mr. H. H. Johnson responded, remarking that electricity used to be a branch of engineering, but now it seemed as though engineering were becoming a branch of electrical engineering.

Mr. J. S. Highfield, M.Inst.C.E., proposed the health of the President, referring to Mr. Gill's scheme for world-wide telephony and the abandonment of parochialism in that industry. He said the N.A.S.E. was going far to bring about complete unity between master and man; only by that means could prosperity be attained. Responding, Mr. Gill quoted American figures, showing that 50 per cent. of the electrical energy sold in the United States was for domestic use, and 90 per cent. of the retail shopping in the United States was done by women. Members of the Association who went into private houses and met the women could put forward the use of electricity to relieve domestic labour. It was not so much a question of economy as of labour-saving. In the United States 40 per cent. of the people lived in houses that were electrically wired, and no less than 140 million pounds was invested in electric irons, cleaners, and washing machines alone. Men who seriously set to work to make themselves efficient were bound to gain recognition, and they were determined that membership of the N.A.S.E. should be the hall-mark of keenness and efficiency. Thanking the Committee which ran the dinner, and Mr. Brammer for his personal help, he called on the latter to speak, and Mr. Brammer, in response, stated that the Association was rapidly approaching the position that it aimed at. Its success was due to the whole-hearted support of the rank and file.

The speeches were interspersed with a musical programme, and the evening proved in every way successful.

Aeroplane Collides with Overhead Line.—It is reported from Seville that during a flight at the Tabada Aerodrome an aeroplane collided with a high-pressure overhead line. Both the pilot and the observer were seriously injured.

Exports and Imports of Electrical Goods and Machinery in January, 1925.

THE export figures for last month are notable for the advance which they show both in comparison with the previous month's figures and those of January, 1924, the total £1,727,535 being £350,349 higher than in December, and £471,885 more than in January, 1924. As compared with December the increase was principally due to large exports of submarine cable amounting to £273,000; increases also occurred in electrical machinery exports £106,500, glow lamps £13,000, and telegraph and telephone wires and cables £20,000. A falling off is recorded in batteries and accumulators to the extent of £17,900 and in meters and instruments (£17,000). As compared with January, 1924, substantial increases occurred in all sections of the exports with two exceptions, are lamps and parts, and switchboards (not telegraph and telephone).

Imports of electrical goods and machinery for January totalled £497,923, less than £57,292 in the previous month (electrical machinery imports being £46,000 down), but they were £201,642 higher than in January, 1924. Electrical re-exports for the month were £14,128 more than in December, but £566 less than in January of last year.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Jan., 1925	Inc. or dec. as compared with Dec., 1924.	Inc. or dec. as compared with Jan., 1924.	Electrical imports for Jan., 1925.	Inc. or dec. as compared with Dec., 1924.	Inc. or dec. as compared with Jan., 1924.	Electrical re-exports for Jan., 1925.	Inc. or dec. as compared with Dec., 1924.	Inc. or dec. as compared with Jan., 1924.
Electrical goods and apparatus (unenumerated)	£156,323	− £5,369	+ £12,566	£100,451	− £6,929	+ £28,194	£10,862	+ £6,655	+ £5,115
Insulated wires and cables	236,8 3	+ 6,168	+ 21,070	55,253	+ 4,342	+ 30,105	1,013	+ 22	+ 848
Glow lamps	43,722	+ 13,028	+ 16,403	36,176	− 74	+ 23,561	227	− 387	− 3,951
Arc lamps and parts	240	− 419	− 1,289	1,439	− 418	+ 494	153	+ 107	+ 5
Batteries and accumulators	77,152	− 17,907	+ 23,078	67,644	− 6,837	+ 45,715	524	− 1,529	+ 254
Meters and instruments	17,655	− 17,467	− 29,032	19,984	+ 3,819	+ 3,098	2,787	+ 1,811	+ 2,424
Carbons	4,080	+ 2,899	+ 2,315	7,667	− 487	− 2,383	205	+ 123	+ 169
Electrical Machinery—									
Electrical machinery (unenumerated)	240,292	− 12,214	+ 64,443	63,979	− 46,094	− 6,695	6,710	+ 1,164	− 649
Railway and tramway motors	72,156	+ 33,996	+ 32,367	—	—	—	—	—	—
Other motors and generators	258,830	+ 84,119	+ 21,727	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	7,290	+ 599	− 5,997	75	+ 24	+ 70	924	+ 924	+ 924
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	84,214	+ 20,223	+ 17,693	16,603	+ 5,623	+ 12,388	106	+ 106	+ 106
Submarine telegraph and telephone cable	273,516	+ 246,420	+ 237,143	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus	255,252	− 3,727	+ 59,458	128,712	− 5,761	+ 67,095	9,148	+ 5,132	− 5,841
Totals	£1,727,535	+ £350,349	+ £471,885	£497,923	− £57,292	+ £201,642	£32,659	+ £14,128	− £566

The Wireless Telegraphy and Signalling Bill.

To Re-enact and Amend the Law.

THE Wireless Telegraphy and Signalling Bill which has been introduced in Parliament by the Postmaster-General and read for the first time, provides, *inter alia*, that a wireless telegraph station shall not be established or maintained in any place, on board ship, or aircraft without licence, the penalty being (*a*) on conviction on indictment imprisonment, with or without hard labour, for a term not exceeding 12 months, or a fine not exceeding £100, (*b*) on summary conviction imprisonment, with or without hard labour, for a term not exceeding three months, or a fine not exceeding £50, and of £5 for each day the offence continues. A justice of the peace, if satisfied by information on oath, may grant a search warrant to any police officer which shall authorise him to enter and inspect any place and to seize any apparatus which appears to him to be used, or intended to be used, for wireless telegraphy therein.

The expression "wireless telegraphy" means any system of communication by telegraph as defined in the Telegraph Acts, 1863 to 1924, without the aid of any wire connecting the points from and at which the messages or other communications are sent and received. Where the sole object is to conduct experiments, a licence for that purpose shall be granted, subject to such conditions and restrictions as the Postmaster-General may think proper, but shall not be subject to any rent or royalty.

Where a station is to be used solely for sending or receiving telegrams which are within the first or second exception from the exclusive privilege conferred upon the Postmaster-General by the Telegraph Act, 1869, a licence for that purpose, if granted, shall not be subject to any rent or royalty. These provisions shall not prevent fees (periodical or otherwise) prescribed for the purpose being charged in respect of the grant or renewal thereof.

The Postmaster-General may make regulations (*a*) as to the terms subject to which licences or any class of licences are to be granted, renewed, suspended, or withdrawn; and (*b*) requiring any operators or other persons engaged in the working of wireless telegraphy to be provided with certificates, and making provision as to the manner and conditions of the issue and renewal of any such certificate, including the examinations and tests to be undergone, and the form, custody, production, cancellation, suspension, endorsement and surrender of any such certificate, whether issued before or after the passing of this Act; and (*c*) as to the extent to which this Act is to apply to British ships and aircraft registered elsewhere than in Great Britain, Northern Ireland, the Channel Islands, or the Isle of Man, and to foreign ships and aircraft, and (*d*) for giving effect to, and securing compliance with, the provisions of any international convention.

Any person acting in contravention of the above-stated regulations will, on summary conviction, be liable to imprisonment for a term not exceeding three months, or to a fine not exceeding fifty pounds, and five pounds for each day during which the offence continues, and to forfeit apparatus. Every regulation made under this section is to be laid before both Houses of Parliament.

The provisions of the Bill are to apply to any visual or sound signalling station used for communication with ships at sea as they apply to wireless telegraphy stations, and will also apply to apparatus for utilising etheric waves for sending or receiving energy without the aid of any wire connecting the points from and at which the energy is sent and received.

The Postmaster-General may during an emergency make rules with respect to the possession, sale, purchase, construction, and use of apparatus for any such purpose, or component parts of such apparatus, and impose penalties.

The Wireless Telegraphy Act, 1904, and the Wireless Telegraphy Act, 1906, are repealed, and for removing doubts as to the construction of the Wireless Telegraphy Act, 1904, it is declared that any references in that Act to transmission in relation to messages shall be deemed always to have included references to the reception of messages.

The text of the Bill (No. 20) can be obtained from H.M. Stationery Office, price 3d.

Recovery of Iron from Copper Ores.—Mr. W. F. Lamoreaux, general manager of the Ducktown Iron, Copper and Sulphur Company, in co-operation with engineers of the Tennessee Copper Company, has succeeded in working out a process which permits a profitable recovery of the iron in copper ores. Copper ore mined by the Ducktown and the Tennessee companies for a decade contains about 35 per cent. of iron, but hitherto the processes for the recovery of iron during the extraction of copper have not been commercially practicable.—*Reuter's Trade Service* (Chattanooga, Tenn.).

Legal.

Boswell v. Belfast Corporation.

In the King's Bench Division of the High Court of Northern Ireland, before Mr. Justice Brown recently, an action was brought by Major Andrew Boswell, Wolverhampton, against the Belfast Corporation, to recover £9,714 for work and labour done and material supplied in connection with a tramway reconstruction contract entered into between the parties in July, 1923, and for £967 damages for the negligent and improper rejection of a cargo of cement by the defendants. Mr. E. S. Murphy, K.C., applied on behalf of the defendants, for an order that all proceedings in the action be stayed, and that all matters in dispute therein be referred to the arbitration of the president of the Institution of Civil Engineers or other persons appointed by him in accordance with an agreement in writing between the parties, and that the submission to arbitration be received and made a rule of Court, and that the plaintiff pay the defendants' costs.

Mr. JOHN M'GONIGAL, K.C., for the plaintiff, opposed the application. He submitted that the action should be allowed to go on in the High Court. After legal argument, the parties agreed to allow certain matters to proceed to trial, and to submit others to arbitration.

His LORDSHIP ordered each party to bear its own costs.

Tungstalite, Ltd., v. Raymond.

MR. JUSTICE ROMER, in the Chancery Division, on February 13th, had before him a motion by the plaintiffs against Raymond, Lisle Street, W., for an injunction restraining defendant from infringing their trade mark.

Mr. MORITZ, for the plaintiffs, said there was a contest of fact. The defendant denied that he had sold radio crystals in what plaintiffs alleged were forged bottles with forged labels. He (Mr. Moritz) asked for a speedy trial, therefore, and also an undertaking by the defendant pending the trial of the action.

Mr. DUNCAN KERLY, K.C., for defendant, said he was not prepared to give an undertaking, as his client had not sold the spurious articles, and did not intend to do so. All possible precautions had been taken not to deal in the spurious articles, but if any had been sold it was because they were supplied by others among other goods. The defendant could not be sure that what had happened once would not happen again. Therefore he could not give any undertaking.

Mr. MORITZ asked that the motion should stand over for a week to answer defendant's evidence.

His LORDSHIP assented.

Sterling Telephone & Electric Co., Ltd., v. Direct Wireless Co.

THE motion by the Sterling Telephone & Electric Co., Ltd., for an injunction restraining the defendants from selling headphones below the stipulated price (*vide* our last issue, p. 280), was settled when it came before Mr. Justice Romer in the Chancery Division on February 11th.

Defendant's counsel said he had consented to an order for a perpetual injunction, and had agreed to pay the plaintiffs 30 guineas as costs, the plaintiffs waiving their claim to an inquiry as to damages.

Correspondence.

Correspondents should forward their communications* at the earliest possible moment.** ***No letter can be published unless we have the writer's name and address in our possession.

The Closing of Finsbury Technical College.

I have read with interest Mr. Church's letter in the current issue of your paper, and I sincerely hope the staff will be honourably dealt with when the L.C.C. closes the College.

At the same time, the L.C.C. is not inclined to trouble too much about individuals, and ordinary conceptions of such things as honouring agreements, &c., go by the board when one is so unfortunate as to have any dealings with its Education Department.

I held an appointment at Hackney Technical Institute for some years as head of the Electrical Engineering Department, and had an agreement with the governing body of the Institute that when the L.C.C. took the place over "my duties were to continue on the same terms and conditions." When the time came for the L.C.C. to take the place over my little agreement was "*set aside*," and I had therefore to resign and seek pastures new.

My suggestion, therefore, to anyone so unfortunate as to be in the hands of the L.C.C. is that the L.C.C. will pay *no attention whatever* to years of service, and as they will probably receive very rotten treatment, they should leave the place *now*, and choose some more certain source of livelihood than technical teaching. If they remain they will have to sign a book when they come in, and when they go—which seems to be the chief matter in an educational establishment under L.C.C. regulations.

A friend once remarked to me when he heard that the L.C.C. was taking over the Institute in which I was working: "Oh, God help you!" and I can only echo these sentiments.

W. H. F. Murdoch, M.I.E.E.

London, *February 13th*, 1925.

Water Power on the Avon.

I read with interest the account of the starting of the small hydro-electric station at Ringwood, Hants.

The remark made at the opening, concerning the River Avon "now doing an honest day's work," struck me because I believe there is another hydro station on the same river. There is at Netheravon, Wilts., a power house of the War Department, on the site of an old water mill, and whilst I have been by it I have not been within, but am given to understand that the machinery is water driven. If this is so, there are *two* water power stations on the same river, which must be something of a record in this country where water power is so little used for electrical power generation. Perhaps you or some of your readers can tell us more about the Netheravon station.

Ernest A. Odam.

Maldon, *February 9th*, 1925.

[We are informed that there are seven water-power installations at work on the Avon between Salisbury and the sea.—EDS. ELEC. REV.]

The Depreciation of the Electric Strength of Oil During Storage.

For some time electrical engineers have discussed whether insulating oils depreciated in electric strength during storage.

An advertisement appearing in your journal for February 6th appears to suggest that under certain conditions the electric strength of insulating oils may deteriorate comparatively rapidly after purificatjon.

Being interested in this subject, I have made a search for the report referred to in the advertisement in question, and find that this evidently refers to the extensive series of tests made on a De Laval centrifugal oil purifier, the results of which were recorded in the ELECTRICAL REVIEW for December 5th, 1924.

On reading through the above-mentioned article, which is a most valuable contribution to our knowledge of centrifugal purification, I find that of the numerous results recorded, the tests being on such a scale that 300,000 gallons of oil were used, it was only when the oil was exposed in an unheated works in the Manchester district for a week-end during dull and rainy weather, that any appreciable deterioration of the oil took place.

Under such adverse conditions, it is only to be expected that due to condensation on the sides of the tank and possibly also on the surface of the oil (for although covered, the tank was probably by no means air-tight), sufficient moisture would get into the oil to cause the reported depreciation in electric strength. Tests which I have made on oil which has been passed through a De Laval centrifugal oil purifier have shown that if stored under fair conditions, there is no depreciation in the electric strength whatever, and this appears to agree with the results recorded by your advertiser for the machine advertised.

I therefore suggest that we may assume that provided insulating oil is stored under reasonably good conditions, no depreciation of its electric strength occurs; but that proper precautions must be taken, particularly during damp weather, to prevent moisture entering the oil due to condensation or other causes.

Refiner.

February 11th, 1925.

Amongst the advertisements in your excellent journal for February 6th, I note results of tests on two makes of centrifugal oil purifiers.

The advertisement in question attempts to compare results obtained with what are evidently two rival machines, but in my opinion it is very doubtful if the two sets of tests referred to are on such a footing as to be capable of comparison in the way intended.

On referring to the ELECTRICAL REVIEW for December 5th, I have found a very interesting article by Mr. H. D. Jukes recording the results of tests carried out with a De Laval centrifugal oil purifier, during which a quantity of about 300,000 gallons of oil was passed through the De Laval machine.

It appears that the statement made in the advertisement in question is intended to refer to Mr. Jukes's test No. 13, which undoubtedly was carried out on a large commercial scale in works which are stated to have been unheated and during weather which is recorded as being dull and rainy.

From my own experience with insulating oils and from a study of the work of others, it is extremely difficult to get reliable values for the dielectric strength of insulating oils unless tests are carried out on a very large scale, such as those made by Mr. Jukes on the De Laval centrifugal oil purifier.

I would suggest that it would be of general interest if the writer of the advertisement referred to above would give full particulars under which the tests made on his machine were

conducted, in order that we might have an opportunity of knowing if the results were strictly comparable with the results obtained with the De Laval purifier.

C. E. Mackellar.

Whickham, *February 11th*, 1925.

In an advertisement in your journal for February 6th, 1925, I note a reference to the electric strength of a sample of insulating oil which had been passed through a centrifugal oil purifier. The advertisement in question refers to a recently published report recording the results of electric strength tests made on oil which had been passed through another make of centrifugal oil purifier.

I find that the writer of the advertisement in question is evidently referring to the very valuable article by Mr. H. D. Jukes which was published in the ELECTRICAL REVIEW for December 5th, 1924.

In the above mentioned article, Mr. Jukes gives the results of a very extensive series of tests carried out on oil purified by means of a De Laval centrifugal oil purifier, and I note that in the advertisement in question the very lowest figures obtained by Mr. Jukes have been quoted apparently as representing a typical performance of a De Laval machine.

In the public interest I consider that a comparison of the kind made in the advertisement is very unfair, especially in view of the very much higher results reported on the fourteen other tests recorded by Mr. Jukes.

It will be noticed that in Test No. 13 to which the above mentioned advertisement evidently refers, it is stated that during the period when the oil was left standing, the weather was dull and rainy. Anyone who has had experience in handling insulating oils knows that it is far more difficult to maintain a high electric strength during wet weather than during dry weather.

This is borne out by Mr. Jukes's Test No. 10, where a similar series of tests was carried out during fair and warm weather, in which case the electric strength of the oil only fell by 5 kV.

Truthful James.

February 12th, 1925.

P.S.—I would add that I have no financial interest in the manufacture or sale or any oil purifier.

Notes on Loud-speaker Design.

Mr. Mortimer A. Codd describes some very interesting tests under the above heading in your current issue. It would seem, however, that he does not fully appreciate the fact that, first and last, the loud speaker is an acoustical instrument, and that unless the principles of construction are based on known acoustical laws, faithful reproduction will not be obtained. He likens the loud speaker to an electromotor. Why not compare it with a stringed musical instrument, and then see wherein its functions differ?

Obviously, the vibrations of the diaphragm in an instrument employing the principles originated by Graham Bell will not impart to the surrounding air the original note transmitted to it. If the diaphragm be regarded as a string which is struck by an electromagnetic influence, it is unable to respond freely to such influence owing to the tension of the permanent magnets, which exert a pull on one side. True, the introduction of damping arrangements, and the addition of a horn, help to rectify these defects. At the same time, it will be admitted that such arrangements are by no means conducive to true reproduction.

In your issue of September 19th last, you referred to my telephone receiver, which, when operated at loud speaker power, is capable of giving very true reproduction, without the aid of a horn, or substitute for a horn. I hope to be able to publish details (which are the subject of British and foreign patents) very shortly.

It may interest Mr. Codd to know that a loud speaker of my design, giving both excellent tone and volume, has been constructed, and the total dimensions *overall* do not exceed 4 in. by 3¼ in.

Leslie G. Toplis.

Bothwell, *February 9th*, 1925.

The Illumination of Large External Areas.

With all respect, I think Mr. Toplis distorts the position, as the lantern I referred to was designed to achieve something which had never been done previously, and the lantern embodies in itself mirrors which give similar results to what Mr. Toplis himself suggested, with his large separate mirror or reflector, in addition to his light source. That the lantern also embodies multiple projecting lenses which pick up light from the lamp filament, and put what would otherwise be lost in the way of illumination to material advantage in *added light* delivered, as I think to the good.

I have twice agreed with Mr. Toplis as to the intrinsic brilliancy of the arc crater, but I have also pointed out the disadvantage of such an arrangement in first cost, which is a material factor in these lean days.

The question of lenses not being required is not quite the fact, for even the projector arc has a main lens of some form, usually.

I know quite well that there are "automatic feed" projectors in being, but their price would further increase the prime cost of such a scheme as was suggested by Mr. Toplis (over "hand feed" arrangement), and he himself mentioned "trimming," &c., as an extra cost under maintenance, to be taken into consideration. No such trimming and replacing of carbons and so on, is necessary in the case of these 7-lens lanterns, a new lamp only being required, after the lamp installed has burnt its useful life. This would be about 1,000 hours, as against 10 hours for the projector arc. Whilst the illumination from a fixed reflector would be on a fixed area, the adjustable mirrors in the Blaizolite lantern make it possible to modify any such area of illumination, without moving the lantern's position, and this is again a material advantage.

As to the fixing of the 10-foot mirror and Mr. Toplis's suggestion of "Crane designers," what would the comparative cost be of fixing the 10-foot mirror, as compared with the fixing on a pole or building of a lantern about 24 inches in diameter, tapering off to reduce wind pressure, and weighing about 56 pounds in all?

In effect, Mr. Toplis's own suggestion is carried out in another form by the Blaizolite lantern, and at a much lower first cost, which is the main thing after all; and the area of illumination is changeable as required, and is not a fixed area, as it would be with his projector and 10-foot mirror. I have given details of concrete instances where these lanterns are employed, and they are *not* in the embryo stage.

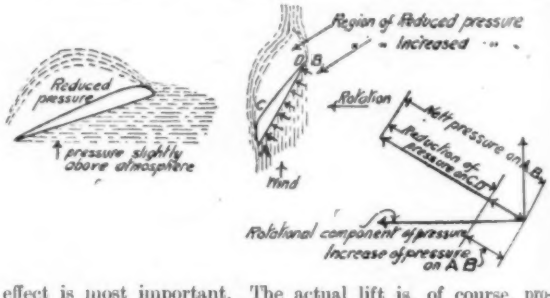
Thanking you for your courtesy, and also for the letters forwarded from people interested in these lanterns.

H. E. Johnson.

Manchester, *February 10th*, 1925.

The "Aerodynamo."

I was interested in the article in a recent issue on the "Aerodynamo." The fact that greater efficiency is obtained by putting the generator and mast in front of instead of behind the propeller is rather interesting and appears at first sight very remarkable. I have looked into the matter a little and perhaps the following explanation might be of interest to other of your readers. Take the case of an aeroplane flying in a horizontal direction. To keep it in the air a continuous force having a vertical upward component has to be exerted on it. The only medium available to exert this force is air. The planes of the machine will be slightly inclined upwards and most people would at first imagine that this force was entirely provided by the excess of air pressure above atmospheric exerted on the undersides of the planes, caused by the impinging of the air on the moving planes. It is, however, the *net* upward pressure which provides the lift, *i.e.*, the excess of pressure on the underside above that on the top side. This may be provided by increasing the air pressure underneath or decreasing the air pressure above the plane. Both these effects can, and in fact always do, occur simultaneously in the case of the aeroplane. It will be readily understood that when a plane slightly inclined upwards moves forward there will be a region of reduced pressure on the top side, due to the inertia of the air. The experiments of aeronautical experts have proved that this



effect is most important. The actual lift is, of course, provided by the net or effective upward pressure; but the important point is that the *reduction of pressure below atmospheric on the top is numerically much greater* than the increase of pressure on the underside. Generally it may be taken that in a well-designed wing the reduction of pressure on the top is about three times the increase of pressure below. For example, assume that atmospheric pressure is 15 lb. per sq. in. and that we have a net upward pressure on the plane of 4 lb. per sq. in. of wing surface. Then the mean pressure on the underside would be about 16 lb. and on the top 12 lb. per sq. in. When the plane is at rest on the ground the pressures on the two sides of the wing are of course equal. To cause a "lift" we have to bring about a change in these pressures and it is in the region on the top of the wing that the change is greater by far. Clearly then the top side is the more effective from the design point of view, though its effect is, strictly speaking, indirect in that it merely makes the positive pressure beneath more effective. Similar reasoning applies to the wind motor. The wind strikes the propeller vane which is slightly inclined to the direction of the wind as in the case of the aeroplane. This will cause a slight increase of pressure on the windward side and also a numerically much greater reduction on the leeward side.

There will thus be a considerable pressure difference between the two sides and this pressure will have a component at right angles to the direction of the wind, this pressure difference being chiefly due to the action at *the back of the propeller*. If now obstructions, such as masts or generators, were placed in the old way just behind the region of reduced pressure the

air could not get away quickly, but would tend to pile up in the region of the obstruction. This would increase the pressure immediately behind the vane which we want to keep as low as possible, or in steam technology "spoil the vacuum." The old-fashioned, but artistic, windmills with their cumbersome structures behind the vanes were therefore constructed on just the wrong principle.

The above does not pretend to be a complete analysis of the rather involved actions of air currents on propellers, &c., but it indicates why the necessary obstructions such as generators, mast, &c., are now placed on the least effective side of the propeller, *i.e.*, in front.

R. F. Damsell.

Rugby, *February 11th*, 1925.

Lead-covered Wiring and Visible Bonding.

Mr. Milner when speaking of lead-covered wiring refers to shoddy workmanship, but is this not common to all wiring systems?

What is necessary with lead-covered systems is the use of robust fittings and the discouragement of the nasty flimsy gadgets used in bonding.

The bonding is the be-all and end-all, and I am pleased to see that the question of visible bonding has been brought up. It *is* important.

Enthusiast.

February 14th, 1925.

German Terms.

On page 254 of your current issue, under "The Leipzig Spring Fair," you speak of it as "A Technical and Building Fair." I would point out that the German word "technisch," in addition to meaning "technical," also means "industrial," and surely the latter is the right translation here. "Ein technisches instrument" means an "industrial type of instrument" as distinguished from a laboratory or special type.

The Leipzig Fair is, I believe, an industrial affair, where goods of nearly every description are sold. I would not trouble you with this correction, if it were not that in the last few weeks I have come across the word wrongly used quite a dozen times in technical and non-technical connections.

For instance, I saw a large advertisement on a hoarding for the "Leipzig Technical Fair." In the January issue of *Science Abstracts*, page 2, line 11, the translator speaks of "technical surfaces," meaning the surfaces of "industrial materials." In *The Times* a few days ago its correspondent made the German Chancellor say that he did not think that certain clauses in the Dawes Report were of "technical importance," when from the context the word "industrial" was obviously the right one. Again, in the "German (*sic*) letter" in *Industrial and Engineering Chemistry* of January 20th, the writer speaks of "technical combustible gases," and incidentally goes on to say that writers should guard against the introduction of superfluous and ambiguous expressions, &c.

D. V. Onslow, A.M.I.E.E.

London, *February 14th*, 1925.

Electric Ophthalmia.

My attention has been called to a recent report in your REVIEW of some observations made by Dr. Gilchrist on the increase of electric ophthalmia, and the symptoms and treatment of this condition. The surgeon is reported to have indicated the importance of protecting the eyes, by the use of smoked or coloured glasses, of those engaged at or near strong arc lights or who are exposed at any time to actinic rays emanating from artificial sources.

Will you permit me to point out in this connection that the researches of Sir William Crookes resulted in the discovery of certain lenses which have the peculiar property of absorbing the ultra-violet rays, which are responsible for the damage to the tissues to which the doctor alluded? Of these anti-actinic lenses, the Vitrex lens seems to be most suitable as a protective medium in the industries with which you are concerned. It has the great advantage of being quite colourless; Sir Oliver Lodge, the National Physical Laboratory, and other leading authorities have established the complete opacity of the Vitrex lenses to the ultra-violet rays. They are consequently an ideal preventive against electric ophthalmia and every sort of eye trouble resulting directly from exposure to injurious chemical rays emanating from artificial sources of illumination.

R. O. Raphael.

London, *February 13th*, 1925.

The I.E.E. Papers.

Your note on I.E.E. papers in your issue of February 13th will be appreciated by most members of that body, and I sincerely hope the Council will take due note of your remarks and suggestions as to procuring suitable papers for the general body of members. There are too many highly technical papers read, full of abstruse calculations and mathematical formulæ, which I feel certain are neither appreciated nor understood by more than about 2 per cent. of the members. The practice of repeating any single paper at various centres as many as ten times in one session is surely not creditable to the Institution or to the 12,000 members of that body and their managing Council. "Youth will be served," as you truly say, but it wants encouragement by the "powers that be."

R. Martill Wilson.

Consett, Co. Durham, *February 14th*, 1925.

Wireless Receivers with Crystal Detectors.

Your readers will be amused by the experience of Mr. Thomas Carter. I am pleased to inform him that such a detector as he calls for I purchased at the Leeds Exhibition, and "Ideal" it is. It is called the "Mic-Met," and is made by C. & J. Arrigoni & Co., Ltd., 8, Compton Passage, Compton Street, E.C.1.

I am sure your readers will be glad to have this information.

V. Delebecque.

London, *February 13th*, 1925.

Business Notes.

The "Electrical Review" Index Reprinting.—Owing to the large demand received for copies of the Index to Vol. XCV (July to December, 1924), a reprint has been put in hand. Readers who are still unprovided with copies and require them for binding and special reference purposes are invited to communicate with the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C.4, who will endeavour to meet all reasonable demands.

Bankruptcy Proceedings.—E. F. HIGGINS (trading as the Western Union Wireless Co.), 99, Regent Street, W.—The first meeting of creditors was held on February 11th, at the London Bankruptcy Court. Mr. F. Vyvyan, Official Receiver, reported that the debtor had not attended under the proceedings, nor had any statement of affairs been lodged on his behalf. An inspector attached to the department of the Official Receiver had called at the address given in the receiving order, only to find that the premises had been demolished with a view to rebuilding. He was referred to an address in Regent Place, but the place was apparently empty. There was no property belonging to the debtor there, and nothing was known of any books or papers belonging to the debtor, whose whereabouts could not be ascertained. The case was left with the Official Receiver to be wound up in bankruptcy.

MONTAGUE RHYS-JONES, public works contractor.—The public examination of this debtor was held at the London Bankruptcy Court on February 10th. The liabilities were stated to be £29,060 (unsecured £14,307), and the assets £182. The debtor said that he and a partner formed the Taranto Tramways & Supply Co., in 1919, to construct and work a tramway at Taranto, Italy. Capital had to be raised on debentures and guarantees by the directors, and he was liable in respect of these. He had also participated in mining business. Debtor attributed his failure to the loss incurred in connection with the construction of sewage works in Brisbane, to the loss on the above-mentioned tramway contract, and the instability of the Italian exchange. The examination was concluded.

W. G. HEAD, electrical engineer, 2, Wellesley Road, Ashford, late of 30a, High Street, Ashford.—Receiving order made February 6th, on debtor's own petition. First meeting February 20th, at the Official Receiver's Office, 10, Burgate Street, Canterbury. Public examination March 21st, at the Guildhall, Canterbury.

M. O. HECKELS, electrical wholesaler and agent, 643, Welbeck Road, Walker, and Star Buildings, Northumberland Street, Newcastle-on-Tyne.—Last day for proofs for dividend February 24th. Trustee, Mr. W. Brittain, Pearl Buildings, Northumberland Street, Newcastle-on-Tyne.

J. WORSLEY, electrician, Hollin Cottage, and 10, Green Street, Darwen.—Receiving order made February 10th, on debtor's own petition.

T. TWIST (T. Twist & Son), electrical engineer and contractor, 20, Carnegie Street and George Street, St. Helens.—Receiving order made February 9th, on debtor's own petition.

W. H. MURAD (W. H. Murad & Co.), wireless manufacturer, 25, Kensington Avenue, and 126, Princess Street, Manchester.—Receiving order made February 9th, on debtor's own petition.

B. E. DIXON (Creswick Dixon Electric Co.), electrical engineer, 110, Shirebrook Road; Bodega Buildings, High Street; 101a, Albert Road; 451, London Road, and 63, Chesterfield Road, Sheffield; and at Electric House, Knifesmith Gate, Chesterfield.—Receiving order made February 7th, on debtor's own petition.

Private Arrangements.—CHARLES HEGNEY & SON, plumbers and electricians, 471, Great Western Road, Glasgow.—A meeting of creditors was held recently in Glasgow, when a statement of affairs presented disclosed liabilities of £1,646, of which £1,146 was due to the trade and the balance to cash creditors. The assets, after allowing £63 for preferential claims, amounted to £1,459, or a deficiency of £187. It was stated that the business was established in 1864. The debtors were desirous of carrying on the business, and after some discussion it was decided to appoint a committee of inspection with a view to a composition being forthcoming. The following are creditors:—

	£		£
William McLeod & Co.	290	Falk, Stadelmann & Co., Ltd.	47
W. T. Henley's Telegraph Works Co., Ltd.	175	Siemens & English Electric Co., Ltd.	39
Mackie & Clarke	72	Garroway, Gibb & Co.	36
Macfarlane & Co.	57	Land & Son, Thomas	31
W. McGeoch & Co.	52	McCallum & Sons	30

E. C. WADDINGTON & Co., Morley Street, Bradford, electrical engineers.—The creditors interested herein were called together recently in Leeds, when a statement of affairs was presented which disclosed liabilities of £1,657. Of that amount £1,645 was due to unsecured creditors, while there were partly secured creditors for £21, the security held being valued at £9, leaving £12 to rank as unsecured. The assets totalled £465, from which had to be deducted £39 for preferential claims, leaving net assets of £426, or a deficiency of £1,232. It was reported that the business was started in October, 1906. The debtor stated that he estimated that he had a surplus of about £100 twelve months ago. A sales day book and ledger had been kept and it was estimated that the loss for the last twelve months had been about £256. The debtor attributed his present position to trade losses. He did not know of his position until proceedings were taken against him. No offer was made and it was decided to request the debtor to file his petition in bankruptcy forthwith.

B. E. DIXON, trading as the Creswick Dixon Electric Co. at Sheffield and Chesterfield.—A meeting of the creditors of the above was held recently at Sheffield, when a statement of affairs was submitted which disclosed liabilities of £2,717, of which £1,397 was due to the trade and £1,320 to cash creditors. The assets amounted to £824, from which had to be deducted £249 for preferential claims, leaving net assets of £575, or a deficiency of £2,142. It was stated that included in the cash creditors was an amount of £222 13s. due to the bank, which held collateral security. The debtor was previously in partnership with another, and a diesolution took place in July last, when it was agreed that the retiring partner should receive as his share a sum of £400, which was still owing to him, and was included in the cash claims. The debtor had not kept a complete set of books, and it had not been possible to prepare any trading figures or a deficiency account. Certain creditors had instituted legal proceedings, and in consequence a deed of assignment had been executed to Mr. P. Beard as trustee. It was decided that the estate should be dealt with in bankruptcy. A further announcement appears under "Bankruptcy Proceedings."

Company Liquidations.—ENAMELLED WIRES, LTD.—A meeting of members is called for March 12th, at the office of Messrs. T. S. Sheard, Carr & Vickers, 13, Harrington Street, Liverpool, to hear an account of the winding up from the Liquidator, Mr. E. Vickers.

NAPIER-KIMBER, LTD.—A petition for the winding up of this company has been presented to the High Court by Messrs. Johnson & Phillips, Ltd., of 12, Union Court, Old Broad Street, E.C., creditors, and will be heard in London on February 24th.

TUNGSTEN & ALLOYS, LTD.—Winding up voluntarily. Liquidator, Mr. B. C. Davies, 6, East Parade, Sheffield.

NORTHERN RADIO CO., LTD.—Particulars of claims to be sent to the Liquidators, Messrs. W. A. Appleton and W. L. Sibley, 23, King Street, E.C., by February 28th.

Dissolution of Partnership.—LONDON RADIO CO., dealers in wireless components, 20, Queen's Arcade, Leeds.—Messrs. W. Shaw and H. A. Riche have dissolved partnership. Mr. Riche will attend to debts and continue the business under the same style.

Catalogues and Lists.—THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—Leaflet No. 704, illustrating and describing "Bencolite" lighting units.

MESSRS. JAMES GORDON & CO., LTD., Windsor House, Kingsway, W.C.2.—An illustrated brochure dealing with the "Rheograph" patent water flow recorder.

MESSRS. E. P. ALLAM & CO., 107-109, Gray's Inn Road, W.C.1.—List of d.c. motors in stock.

THE GLOBE ENGINEERING CO., LTD., Brighouse.—List No. 10, containing particulars and prices of the company's standard d.c. motors and dynamos.

THE STONEBRIDGE ELECTRICAL CO., LTD., Victoria Road, North Acton, W.3.—List No. 81, illustrating and describing recording switchboard and portable ammeters, voltmeters, wattmeters, power factor meters, &c. Priced.

THE LISENIN WIRELESS CO., Connaught House, 1a, Edgware Road, W.2.—An illustrated trade price list of radio components and accessories.

MESSRS. J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall.—An illustrated folder containing details and prices of the company's 5- and 15-A combined tumbler switch and plug-socket.

THE HENRY WELLS OIL CO., 11, Haymarket, S.W.1.—A chart giving a summary of lubrication progress made during the period 1920-24. Interested firms can obtain unfolded blueprints of this from the company.

OLIVER PELL CONTROL, LTD., Granville House, Arundel Street, W.C.2.—A priced and detailed catalogue of special nickel-chromium alloys produced by the Electrical Alloy Co. (U.S.A.), for which the company is the sole distributor in Great Britain.

THE MAYBROOK ELECTRICAL CO., LTD., 15 & 16, White Cross Place, London, E.C.2.—Full reprint, for circulation to the trade, of *The Times* report of the recent House of Lords judgment in the electric lamp patent case.

Trade Announcements.—THE STILL ENGINE CO., LTD., is concentrating its administrative and designing work in the same building as its Research Laboratory, and all communications should now be sent to Church Wharf, Chiswick, London, W.4. Telephone No.: "Chiswick 1300." Telegraphic address: "Nuprimover, Phone, London."

MR. WALTER KIRKHAM, electrical engineer, has opened a new establishment in Tinker Brow, Union Road, Oswaldtwistle.

MESSRS. T. BEADLE & CO., LTD., have opened a new wholesale depôt for wireless and electrical goods at Newport Place, Northampton Street, Leicester, and Mr. Derek Hought, formerly with the firm at Stoke-on-Trent, is in charge. Tel. No. "4522 Leicester."

THE ST. HELENS CABLE & RUBBER CO., LTD., has found it necessary to install an extra telephone line in its London office (70, Petty France, Westminster, S.W.). This involves the changing of the telephone numbers to "Franklin 6181 and 6182."

MR. ALEXANDER MILNE is relinquishing his connection with Messrs. Malcolm & Allan, Ltd., as manager of their Edinburgh branch this month and is starting on his own account early in March as an electrical engineer and contractor at 180, West Regent Street, Glasgow.

Catalogues Wanted.—MESSRS. NEEDHAM BROS., electrical engineers and contractors, Market Place, Sutton-in-Ashfield, wish to receive catalogues of electric lighting accessories, conduits and fittings, motors, &c.

Chinese Notes.—The Tsing Tsung Electric Light Co., at Nanzin (Chekiang), is shortly installing a 200-kW, 3-phase, 60-cycle, 2,300-V generator belt-driven by a steam engine.

The Changshu Electric Light Co. (Kiangsu Province) is negotiating with a Shanghai firm for the installation of two new 50-kW sets.

The Wuchang Commercial Port Electric Light Co. is being organised to operate at Kowkow and in the vicinity of the Canton-Hankow Railway Administration, Wuchang, where the Wuchang Electric Light Co. does not operate.

To ensure full use of its plant during the day-time the Taiyuan Electric Light Co. is operating a flour mill, selling the product under the mark of the "Electric Lamp."

A telephone line between Woosung and the Chapei district of Shanghai is to be put into operation during the spring. The system will be under Chinese control.

The E.D.A. at the Ideal Home Exhibition.—The British Electrical Development Association is circulating an advance pamphlet calling attention to its display at the approaching Ideal Home Exhibition. This refers particularly to the devices for lighting, warming, cooking and cleaning which will be on view.

Mr. G. W. Robinson informs us that the fountain which is being erected in front of the E.D.A. display (*vide* our last issue) has been produced by his firm. The same firm is also supplying a larger electric fountain (8 ft. in diameter) for the centre of the main Olympia building. In addition, Messrs. Robinson's are supplying the special lighting fittings for the annexe.

Electricity Supply Workers' Wages.—Upon the recommendation of a special committee, District Council (No. 2), Electricity Supply Industry (Yorkshire, &c.), has decided that until the cost-of-living figure falls to 72 per cent. on the average for three months in accordance with the sliding scale agreement of November 4th, 1921, no reduction shall be made in the rates of pay of the men whose grades are set out in the schedule of rates of the District Council, and that if and when the cost-of-living figure falls to 72 per cent. the reductions as set forth in the quarterly notices of the National Council, shall operate, but in order to preserve the ½d. per hour referred to above, which it is intended, the men should retain, the rates of all the grades of employés set forth in the District Council's schedule of rates should be increased by ½d. per hour.

The Census of Production and Wages.—The *Daily Telegraph* states that as the returns which are being called for by the Board of Trade under the Census of Production do not include particulars of the wages paid by employers, the Ministry of Labour is considering arrangements by which this important omission can be rectified. Such information would be of great value, particularly in the case of industrial disputes. United States statistics show that in 1914 the wages paid were 42.1 per cent. of the net output; in 1919 they represented 42.9 per cent., and in 1921, 44.8 per cent. In Canada the proportion is much smaller, having been 35 per cent in 1910, over 37 per cent. in 1915, less than 33 per cent. in 1917, and nearly 36 per cent. in 1920.

American Foreign Electrical Loans.—The issue of *Commerce Reports* dated January 26th, contained a list of the foreign loans floated in the United States during 1924. The following are in the list:—Lower Austrian Hydro-Electric Power Co., $8,000,000; Paris-Orleans Railway Co., $10,000,000; Christiania Tramways, $1,400,000; International Power and Securities Co. (Union d'Electricité, Paris), $4,000,000; Montreal Power & Tramways, Ltd., $8,000,000 (partly sold in Canada); Duke Price Power Co. (Canada), $12,000,000; Winnipeg Electric Railway, $6,000,000; Great Consolidated Electric Power Co., Ltd. (Japan), $15,000,000; and the Manila Electric Railway Co., $500,000.

The Greek Electrical Market.—*Commerce Reports* states that the Greek market for electrical supplies is controlled by price and not quality. Therefore the German suppliers, whose prices are low and who give greater facilities than other suppliers, are in a very favourable position. There are no wiring rules or compulsory inspections; even insurance companies neglect the latter. Simple surface wiring on porcelain supports is usually employed. Rotary switches and the Edison screw socket are in general use.

New "Veritas" Premises in Glasgow.—Lord Provost Montgomery, in the presence of a large company on February 4th formally declared open the reconstructed premises at Great Clyde Street, Glasgow, of Falk, Stadelmann & Co., Ltd. The new "Veritas House" occupies a prominent position on the bank of the Clyde, and the work of reconstruction has been admirably carried out. In the various oak panelled rooms are displays of lighting appliances. On the ground floor are exhibited the most up-to-date lamps, shades, and electroliers, as well as various types of alabaster and crystal glass fittings. On the second floor a special feature is made of electroliers and of Cromwellian, Jacobean, and general period" fittings. The Lord Provost congratulated the company on its enterprise, and referred to the importance of efficient lighting. As a souvenir of the occasion the Lord Provost was presented with a massive electric table standard of chaste design, a specimen of the company's fine work. Among those present were Mr. R. B. Mitchell, general manager of the Glasgow Corporation Electricity Department, and Mr. J. M'Lusky, general manager of the Corporation Gas Department. In the evening a reception was given by the firm, the guests being received by Mr. M. Falk, chairman of the company.

Price Alterations.—Messrs. Fuller's United Electric Works, Ltd., of Chadwell Heath, inform us that the recent increase in the prices of all their portable accumulators has been cancelled as from February 16th.

Messrs. Siemens Bros. & Co., Ltd., of Woolwich, announce that the price of their double headphones has been reduced (quality will be maintained) with the object of stimulating the demand for a sound British-made head telephone.

Marking Foreign Goods.—The Sheffield branch of the National Union of Manufacturers has decided to press forward the adoption of the recommendations of the Merchandise Marks Committee issued in June, 1920, particularly that requiring that all manufactured goods should be distinctly marked with the name of the country of origin.—*Financial Times.*

Boiler-house Equipment Contracts.—Among the recent orders received by Messrs. E. Bennis & Co., Ltd., are the following for municipal electricity undertakings:—Sunderland, two automatically-controlled boiler bucket elevators; Bristol, coal discharging plant, including chain conveyors, an electrically-operated jib crane, &c.; Sheffield, six chain-grate stokers for Stirling boilers; and Great Yarmouth, one automatically-controlled boiler bucket elevator. Important orders have also been received from a number of collieries, textile mills, &c., for boiler-house and ancillary equipment.

Engineering Employés' Wages.—Last week's conference between representatives of the Engineering Employers' Federation and of the engineering trade unions upon the subject of the men's claim for an increase of 20s. per week in their wages, failed to bring out a solution. The employers declared that the state of the industry precluded any increase in production costs, such as would be inevitable if the men's demands were conceded. They offered to set up a joint committee to consider the question of wages in relation to the condition and prospects of the industry. While some of the trade union representatives were inclined to accept this proposal, the majority insisted that an increase should be given. The union representatives are to report the position to their executives on March 4th, when a decision as to the next move will be made.

Swiss Electrical Enterprise in the United States.—Supplementing the note on this subject in our last issue, we learn from the *Electrical World* that the Brown-Boveri Company already has one plant in operation. This is at Sidney, N.Y., where ignition equipment is being made for the United States Navy. This plant also makes rectifier cylinders. Brown-Boveri oil circuit-breakers and mercury arc rectifiers are already in extensive use in the United States, and the company expects to add a complete electrical line of American manufacture and Brown-Boveri design in a short time. Our contemporary says:—"The final results of this move of one of the largest electrical manufacturers in Europe are awaited with interest, and much curiosity exists as to the names of the American firms to be absorbed by the Brown-Boveri interests at an expenditure of upward of fifty million dollars."

Malayan Power Scheme.—The scheme of Sir W. G. Armstrong, Whitworth & Co., Ltd., for developing the power of the Perak River has reached a further stage. According to the *Financial Times* the Finance Committee of the Federal Council strongly recommends the Federal Government to guarantee the interest on 40 per cent. of the debentures which would be issued in connection with the scheme. The Home Government has already promised to do the same if the Federal Government does its share.

Every tin-mining company in Kinta and Larut, the biggest tin-mining districts in the world, has been circularised and this has revealed a great potential demand for cheap power. It is estimated that the capital necessary is about £2,750,000, the greater part of which would be spent on engineering works and transmission lines, the latter being about 60 miles in length. A smaller scheme costing about a million pounds less would not be productive of such cheap power as the larger scheme, as the price will depend upon the size of the supply.

The New "Mazda House."—As we stated in our "Trade Announcements" last week, the British Thomson-Houston Co., Ltd., has moved its Wiring Supplies Department to Newman Street, Oxford Street, where premises have been reconstructed and named "Mazda House." A view of the new premises accompanies this note and from it the building will be seen to be a very extensive one. On the ground floor (Newman Street side) the company has arranged display windows flanking the main entrance. Part of the floor is equipped as a showroom, and the rear portion, with an entrance from Perry's Place, is occupied by a trade counter. The room on the first

The New "Mazda House."

floor is of a good length with a window facing Oxford Street. This is the main showroom and is being used for the display of all types of lighting fittings of the company's manufacture. On this floor there is also a series of cubicles for the isolated display of individual units. Lighting fittings are also exhibited in the basement; these are mainly industrial and commercial patterns. The second and third floors are occupied by offices, storerooms, &c. This new venture is a part of the company's general showroom policy, and follows the extension and re-equipment of the B.T.H. showrooms in a number of important provincial centres.

Electricity Supply Rifle League.—This year, owing to the increase of the number of teams, the League is running the competition for the shield in two divisions, and a deciding match will have to be shot off at the end of the season to decide which team is to hold the trophy for the following year. A prize meeting is held each year for individual "shoots." A silver cup is competed for at this meeting, and a small replica is presented each year to the winner as a souvenir of the event. Information regarding the League can be obtained from the Hon. Sec., Mr. E. Mathews, 306, Mare Street, Hackney, E.8.

The Electrical Wholesalers' Federation, Ltd.—In our last issue we published a report of the proceedings at the annual dinner of this Federation. We may state that the Federation has issued a pamphlet setting forth the Trading Policy of the organisation. The operations of the body have been recorded in our pages periodically from the time of its birth. In the statements now published for the first time as a declaration of the policy for which the E.W.F. stands, there is nothing fundamentally new, nor is there any departure from the principles and precepts which have always governed its action. It is hoped, however, that publication in the present form will carry the matter of fair trading for and between all sections of the industry a step further forward, and those who are seriously interested in the subject could no doubt obtain a copy on application to the Secretary at 19-21, Hatton Garden, London, E.C.1.

The Swiss Electrical Engineering Industry.—From information recently to hand, it appears that the electrical engineering industry in Switzerland during the past year still suffered to some extent from the difficulties experienced since the war, the principal one being a falling off in output owing to the great increase in prices. It is pointed out that as a result of the higher cost of living, wages had to be increased, with the result that they are now more than double those paid for similar work in many parts of Europe. Some improvement took place as a result of a reversion to a 52-hour working week in some of the works, and during the second half of the year there was a distinct change for the better in the business position. At the same time the prices obtained, in view of the high production costs, left very little profit margin, the position not being improved by the keen competition for foreign business that is being experienced from Germany.

Among the important contracts completed or put in hand during the past year are the following. The Ateliers de Constructions Mécaniques de Vevey have delivered to the hydro-electric station at Wynau on the Aar four 2,700-h.p. turbines, to the Interlaken Electric Light and Water Works three 320-h.p. turbines, and to the firm of Brown-Boveri & Co., at Munchenstein, two 270-h.p. turbines. At the same works, groups of five turbines of 12,000 h.p. each are being constructed for the hydro-electric station at Bancairon, on the Tinee, a tributary of the Var in the French Alps Maritimes, and four turbines of 7,100 h.p. each for a power station at Poet on the Durance (France). Both these power houses form part of the development programme of the Société L'Energie Electrique du Littoral Méditerranean. The construction of part of the powerful high-pressure water conduits for the Vernayaz generating station for the Swiss Federal railway authorities has also been entrusted to the Vevey firm.

The yearly report of the firm of Sulzer Bros., Wintherthur, also gives some interesting information concerning the activity of that firm. It is stated that there has been an increase in the number of orders for Diesel engines. Two of 3,600 h.p. have been constructed for the Shanghai power station, where two 1,500-h.p. engines were installed several years ago by the firm.

British Trade Mark Applications. — The following are among the recent applications for British trade marks. Objections to any of the proposed marks mentioned may be lodged within one month from February 11th :—

Receptor. No. 454,459. Class 8. Instruments and apparatus for use in radio telegraphy and telephony.—A. F. H. Morant, 14, Torrington Square, W.C.1.

Rooco. No. 451,416. Class 8. Apparatus for use in radio telegraphy and telephony.—Archibald Rooke, trading as the J. R. Wireless Co., 28, Somerset Road, Tottenham, N.17.

Meepon. No. 454,551. Class 8. Radio telephony instruments.—Meek and Pond, 46, Upper Dean Street, Birmingham.

John Bull Radio Products, Never Beaten (lettering and design). No. 454,849. Class 8. Instruments and apparatus for use in radio telephony and telegraphy.—Jack Bolson, trading as the John Bull Radio Supply Co., 123, Westminster Bridge Road, S.E.1.

Wincrystal. No. 454,584. Class 8. Radio telephonic and telegraphic instruments.—Winfield Bros., Ltd., 152, Newtown Road, Birmingham.

Kapol Paper for Cables, Purity, Reliability, Strength (lettering and design). No. 453,498. Class 39. Insulating paper.—John Pollok & Son, Ltd., 29, Queen Street, E.C.4.

Engineering Exhibition. — Under the auspices of the South Wales Institute of Engineers an exhibition of all kinds of machinery and plant used in works and collieries, &c., will be held at Swansea from August 8th to August 15th. Forms of application for space and all particulars can be obtained from Mr. M. Price, Secretary of the South Wales Institute of Engineers, Park Place, Cardiff. (See our advertisement pages to-day.)

Local Exhibition.—WARRINGTON.—The Warrington Electricity Committee has taken a prominent part in the Ideal Homes Exhibition which has been held at the Empire Hall, Warrington, during the last ten days and concludes to-morrow (Saturday). Not only did the Corporation stands contain a comprehensive range of domestic electrical appliances, but arrangements were made enabling the public to view a series of films demonstrating the all-round utility of electricity in the home. Amongst the films shown were :—"Electric Cookery," "The Power that Serves," "Touch of the Button," "Glasgow Electric House Film," "Electricity, the Key to Comfort in the Home," "Coal Heap to Consumer," "The Perfect Servant who Rules the World," "Electric Farm in Sussex," "E.D.A. Exhibits at the British Empire Exhibition," "Electric Lamp Manufacture" (General Electric Company), and "A Steam Turbo-Alternator in the Making" (Parsons and Co.). Each day there were demonstrations, and to further interest the public in electricity, the Corporation's power station was open to inspection.

Keep Smiling.—*Electrical Merchandising* says that the prize-winning slogan of the electrical industry on the Pacific Coast for the coming year is :—

"Faith Moves Mountains
But Smiles Move Men."

New French Companies.—La Compagnie des Lignes Téléphoniques Terrestres et Sous-Marines (Telemar) is the name of a new cable-manufacturing concern which has lately been organised in Paris (16, Boulevard Malesherbes), with a capital of 100,000 fr.

La Société des Forces Motrices de Videssos is the name of a new company recently formed in Paris 126 (Rue de la Boetie), with a capital of 12 million fr., to establish a hydro-electric station to utilise the power of the Bas-Videssos falls in the department of Ariege.

New Cement Factory.—The Associated Portland Cement Manufacturers are laying out a new cement factory at North fleet, Kent, which, it is said, will be the largest in the country and will represent the most modern practice. The whole of the plant will be driven by electric power, a total of 30,000,000 kWh being the estimated annual requirement.

Lead.—Messrs. James Forster & Co. report (February 14th) that supplies are still on the full side, and there is no lack of prompt lead. The market is in a very sensitive state but they cannot see at the moment any sustained rise in value until the present glut of supplies has been cleared away.

The Rating of Machinery.—The Inter-Departmental Committee on the Rating of Machinery in England and Scotland has now reported, and its recommendations have been published as a White Paper (Cmd. 2,340. Stationery Office, 9d. net). The Committee is of the opinion that machinery users are entitled to some relief in the interests of industry and accordingly it recommends that a certain class of machinery and plant should be partially exempt from rates. This has necessitated the division of machinery into two classes. Class I, which is not exempt, includes electricity, water and gas supply undertakings, tramways, lifts, &c. Class II covers all plant and machinery now by law taken into account in estimating the annual value for assessment to poor rate, other than that which falls within the definition of Class I. This class, it is recommended, should be entered separately in the assessments and charged at a quarter of the full rate. The Committee recommends that professional valuations should be made at intervals of not more than five years.

Bankruptcy Reform.—The Federation of British Industries was recently invited by the Board of Trade to put forward its views regarding the points to be raised at an International Congress which is to meet at the Hague to consider questions relating to international bankruptcies and liquidations of companies. The matter was referred to the special committee which was considering the question of the amendment of the British Company Law. It was decided that the Federation could best assist the International Congress if members would send in details of any cases within their knowledge in which British creditors had suffered undue loss through bankruptcies or the winding up of companies in a foreign country, either owing to defects in procedure or to the fact that a preference was accorded to local creditors.

An "Elma" Lighting Service Dinner.—To mark the conclusion of the second illumination design course organised by the E.L.M.A. Lighting Service Bureau, the directors entertained those who attended the course to dinner at the Engineers' Club on February 13th.

Mr. C. W. Sully occupied the chair, and after the toast of "The King," he proposed the toast of "E.L.M.A. Service." He said that about 110 had attended the course from all over the country. The aim of the organisers was to make sure that illumination ideas were properly applied. Mr. Cleary (Brighton), Mrs. Pearman (Hackney), Mr. Mounsden (Sevenoaks), and Mr. Howell (Battersea) all testified to the excellence of the course and the benefit which all the "students" had derived from it. Special mention was made of the sympathetic treatment of the subjects of the course by Mr. W. E. Bush.

Mr. J. W. Beauchamp (E.D.A.) said that it was often hard to convince Electricity Committees of the value of such a course, but they could rest assured that the small expense would be more than repaid. Lighting was of the first importance, and augmented lighting led to orders for more machinery, cables, and all kinds of apparatus. Mr. Bush said that we in this country were far behind in illumination; the raising of the standard would lead to an enormous amount of work for all branches of the industry. Mr. S. Rentell promised the support of the technical Press for the efforts which were being made by the E.L.M.A.

Social Events.—On February 10th, at the Court Hall, Wigan, the staff and employés of Messrs. Heyes & Co., Ltd., of Water-Heyes Electrical Works, Wigan, were entertained by their employers. Supper was followed by a whist drive and dance. The prizes were distributed by Mrs. W. A. Heyes, wife of the managing director.

The annual dinner of those connected with the electricity undertaking was held at St. Helens on February 10th. The deputy-mayor (Ald. Phythian), the borough electrical engineer (Mr. F. Rendell Baker), Mr. B. H. Garside (Brush Electrical Engineering Co., Ltd.), and members of the staff and Electricity Committee were present. In proposing the toast of "The Mayor, the Chairman (Col. W. N. Pilkington, D.S.O.) and the Members of the Electricity Committee," Mr. Baker spoke of the progress of the undertaking and its importance in the industrial life of the town.

Unemployment.—A further fall in the number of registered unemployed occurred during the week ended February 2nd, when the total stood at 1,237,000, as compared with 1,240,922 a week earlier.

For Sale.—Croydon Borough Council Electricity Department has for disposal one 1,000-kW and one 750-kW Belliss Dick, Kerr d.c. generators, with control panels, one surface condensing plant, and two 12,500-lb. Babcock & Wilcox land type boilers. Messrs. Farebrother, Ellis & Co. will sell by auction at the London Auction Mart, Queen Victoria Street, E.C., on March 19th, freehold modern factories and warehouses situate at Twickenham. (See our advertisement pages to-day.)

The British Industries Fair.—The sixth British Industries Fair to be held in Birmingham was opened on Monday last, and it remains open until February 27th. The exhibition has been widened to embrace those classes of goods which hitherto have been shown in London. Particulars of some of the stands will appear in our next issue.

The size of the exhibition can be gauged from the catalogue, which contains the names of over 350 firms, representing a widely varying range of manufactures. The Birmingham Corporation has a large exhibit, demonstrating the work of its various departments.

Book Notices.—"Electrical Circuits and Machinery," by J. H. Morecroft and F. W. Hehre. Vol. II, Alternating Currents. Pp. xi+444; figs. 426. London: Chapman & Hall, Ltd. Price 20s. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LXIII, No. 338. February, 1925. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"The Technology Reports of the Tôhoku Imperial University," Vol. IV, No. 3. Tokio: Maruzen Co., Ltd.—This issue contains two papers of an electrical nature: "On the Voltage Amplification Ratio of the Triode Valve Resistance Amplifier," and "On the Free Potential of the Grid and Plate of the Triode Valve and the Apparent Distribution of the Initial Velocity of Electrons."

"The Story of the Atom," by W. F. F. Shearcroft. Pp. 77. London: Ernest Benn, Ltd. Price, limp cloth, 2s. 6d.; cloth boards, 3s. 6d. net.

"Bismuth Ores," by R. Allen. Pp. ix+62 and map. London: John Murray. Price 3s. 6d. net.

United States Tariff Commission.—The Board of Trade has received a copy of the eighth annual report of the United States Tariff Commission covering the fiscal year 1923-24. This may be consulted by persons interested at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

London Electricity Charges.—The Highways Committee of the London County Council has addressed an inquiry to all the London electricity supply undertakers whose charge to the consumer for the supply of electricity for lighting purposes exceeds 6d. per kWh as to whether any reduction in price is contemplated in the near future.

Portuguese Tariffs.—The *Board of Trade Journal* reports that a decree published in the "Diario do Governo" for January 27th provided for the raising of the following new headings in the Portuguese Customs Tariff:—Radio-electric apparatus for wireless reception or transmission, not including accessories or valves, 50 and 25 cts. per kg. under the "maximum" and "minimum" tariffs respectively; electric sound amplifiers (loud speakers), 40 and 20 cts. per kg. respectively; and unspecified electric lamps, 60 and 30 cts. per kg. In addition, articles of composition pastes for electrical purposes, with or without metal fittings, are now dutiable under Tariff No. 581 (which formerly included only porcelain or faience wares for similar purposes), whilst Tariff No. 821 (which relates to electric lamps) has now been amended to cover "only electric lamps for lighting and heating."

Pulverised Fuel.—The "Lopulco" system of pulverised fuel firing is being adopted in three new generating stations, these being respectively at Belfast, Derby and Billingham. The station at Belfast is for the York Street Flax Spinning Company.

A Wembley Winder.—The electric winding engine jointly exhibited by Messrs. Vickers, Ltd., Barrow-in-Furness, and the Metropolitan-Vickers Electrical Co., Ltd., at Wembley last year, has been purchased by the Burradon & Coxlodge Coal Co., Newcastle-on-Tyne, for its Weetslade Pit. This winder was the subject of considerable interest at the Vickers stand, where it was shown in operation.

Calendar.—THE BRITISH INSULATED & HELSBY CABLES, Ltd., has sent us a substantial calendar consisting of a metal frame bearing particulars of v.i.r. and p.i.l.c. cables, and monthly date cards.

Brazilian Municipal Supply Concession.—The municipality of Cascavel, in the State of Ceara, Brazil, proposes to grant a 25-year franchise for the installation and operation of an electrical plant. The plant is to become the property of the municipality at the end of the franchise period. No taxes are to be collected. Correspondence, in Portuguese, should be directed to the Prefeito Municipal, Cascavel, Ceara, Brazil.—*Commerce Reports.*

Lighting and Power Notes.

Accrington.—ELECTRICITY AGREEMENT.—An agreement has been reached between Accrington Corporation and the Lancashire Electric Power Co. for the supply of such electricity as the latter may require until its new works at Padiham are completed. The agreement will terminate in the autumn of 1926.

PROPOSED CHANGE-OVER.—The Town Council has approved a proposal that the Electricity Commissioners be asked to sanction a change-over in the system of supply in Accrington, Church, and Altham from d.c. 3-wire at 460 V and 230 V to a.c., 3-phase, 4-wire, 50 cycles, 400 V and 230 V.

Ashford (Kent).—ELECTRICITY SCHEME.—In connection with the electricity scheme for the town the Urban District Council has applied for consent to purchase three 6-cylinder b.h.p. oil engines for £16,756, and cables to the value of £18,306.

Bath.—LOAN SANCTIONED.—The Town Council has received sanction to a further loan of £38,000 for extensions to the plant and buildings of the electricity works.

Blackburn.—ELECTRICITY EXTENSIONS.—A scheme prepared by the borough electrical engineer for supplying electricity to the parishes of Witton and Livesey has been approved, and application is to be made for a Special Order to carry out the work.

Burnley.—ELECTRICITY EXTENSIONS.—The electrical engineer has reported to the Corporation that to meet next winter's requirements it will be necessary to lay the following feeders:—From the electricity works to Belvedere Road (£1,256); duplicate feeder for Manchester Road (£3,826); feeder from the sub-station to Melville Street (£1,191).

Bury (Lancs.).—LOAN.—The Town Council has applied for sanction to a loan of £1,815 for renewing mains in connection with the scheme for the change-over of the system of supply.

Canada.—ELECTRICITY SCHEME.—The Provincial Hydro-Electric Commission is to prepare plans for the erection of a steam plant in Toronto for the generation of electricity at a cost of $5,000,000. It is also planned to equip this plant to supply heat to the business section of Toronto, much on the lines of the central heating system in Detroit, which since 1904 has been supplying steam to a large area.—*Reuter's Trade Service* (Toronto).

Canterbury.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £21,500 for extensions to the plant and buildings of the electricity works.

Continental. — CZECHO-SLOVAKIA. — The Skodawerke has just supplied to the Prague municipal power station the first 3,000-r.p.m. turbo-generator constructed in the country. The Brünner Maschinen Fabriks Gesellschaft has also just supplied a locally-constructed 2,000-kW set, complete with four Babcock & Wilcox boilers, to the Aussig works of the Verein für Chemische und Metallurgische Produktion.

SPAIN.—A notice in the *Gaceta de Madrid* of January 5th states that all hydro-electric concessions granted before the decree of June 14th, 1921, are revoked where the companies, their officers and managers, or the contracting or working engineers are not Spanish, as laid down in the Royal Order of July 7th, 1921.

SWITZERLAND.—In order to meet the increasing demand for electricity the municipal authorities of Schwanden (Glarus Canton) have decided to install an additional generating set of 1,400 h.p. at the Niedenbach power station, and are contracting for a supply from the North-East Swiss Kraftwerk at Baden. Negotiations are also in hand with the Cantonal authorities in connection with a demand for a concession to utilise water power above a point known as the Alpsteg-tafels.

The Motor Gesellschaft, of Baden, has recently completed the erection of a new hydro-electric power station at Tremorgio, utilising the water power of Lake Tremorgio under a head of about 2,600 ft. The plant at the station, which it is intended to run only in the winter months, comprises a 15,000-h.p. turbo-generator, and is expected to give an annual output of eight million kWh. The new station has been linked up with those at Cordola (Lugano), Morobbia (Bellinzona), Bodio, and Ponte Brolla, so that in case of water shortage or excessive demand at any of the latter, an electricity supply can be given from the new Tremorgio plant.

As a result of the existing low level of the lakes, the capacity of many of the Swiss hydro-electric stations has been diminished, with the result that power "exported" from Switerland to neighbouring countries has been reduced from 148,000 to 75,000 kW, while in some districts electricity is being "imported" in order to maintain supplies to local consumers.

Epsom.—LOAN.—The Urban District Council has applied for sanction to a loan of £2,250 for a new feeder main.

Guisborough (Yorks.).—INQUIRY.—At an inquiry held on February 13th into the application of the Urban District Council for an Order to supply electricity in the district, objections to the scheme were raised by the Guisborough Gas Co., the London & North-Eastern Railway Co., and a body of ratepayers. For the Gas Co. it was stated that exception was taken to the scheme on several grounds. It was contended that there was no necessity for the Order as there was no adequate demand for electricity either for private or public purposes, that the demand for electricity for power purposes was already fully met by the existing supply afforded by the Cleveland & Durham Power, Ltd., that the scheme had been promoted without sufficient consideration of engineering and financial details, and that the ratepayers were, in the main, adverse to the proposals.

Hamilton.—ELECTRICITY SUPPLY.—The Town Council is protesting against the decision of the Electricity Commissioners that the Council should arrange to close down its power station and take a bulk supply from the Clyde Valley Electric Power Co. The Commissioners express the view that the favourable rates quoted by the company would enable the Corporation to develop its electricity undertaking rapidly. The Council has replied that it is unable to arrange for the closing down of its generating station, and claims that it has been able to produce at a figure which bears favourable comparison with any buying price yet suggested. The Council also states that no evidence has been adduced to prove the incapacity of the existing works, when suitably extended, to produce cheaply and efficiently all the electrical energy required.

Hastings.—LOAN.—The Electricity Committee has recommended to the Town Council that application be made for sanction to borrow a further sum of £7,000 for services.

Hebden Bridge.—ELECTRICITY AGREEMENT.—The Urban District Council has entered into an agreement with the Halifax Corporation for the supply of electricity in bulk to the Council for a further period of seven years, as from September 9th, 1924.

Irish Free State.—CASTLEREA (CO. ROSCOMMON).—A fire occurred recently at the power station of the Castlerea Lighting & Milling Co., Ltd., cutting off the electricity supply. The roof of the station was destroyed and the machinery badly damaged. The source of the outbreak is unknown.

LIFFEY INQUIRY.—The inquiry into the River Liffey hydro-electric power schemes was recently re-opened by the Free State Parliamentary Special Joint Committee. Mr. W. B. Woodhouse, examined in opposition to the Dublin Electricity Supply Bill, said the proposals showed no fixed power maximum, and that there was no general obligation to supply, preference being given to certain users. On behalf of the Dublin Corporation, as promoters of the Dublin and District Electricity Supply Bill, Mr. Serjeant Hanna, K.C., said that for the purpose of electric lighting the Corporation had unlimited borrowing powers. The other companies would not undertake the responsibility attached to the schemes unless they obtained the Corporation business. They would have to purchase the Corporation undertaking at a cost of £2,500,000. Mr. L. Paul, chairman of the Corporation Electricity Committee, said that the Government should finance the scheme in national and civic interests, but if it was unwilling to do so, then the civic government should be the authority. In the four years, 1920-24, the number of Dublin electricity consumers had increased from 9,583 to 12,128, and the energy sold had grown from 10,527,600 to 15,293,110 kWh.

Mr. L. J. Kettle, city electrical engineer, said that the control of electricity supply should be in the hands of municipal authorities; where that had been conceded in Great Britain it made for efficiency.

Herr Buchi, the Swiss expert, further examined for the Corporation, stated that later calculations showed a greater flow in the Liffey than when he prepared his survey report. The effect would be to increase the total output by about 6½ per cent., and reduce the cost per kWh at the transformers from .57d. to .53d.

Mr. E. W. Monkhouse stated that the Corporation scheme was sound, and the estimate of the energy that could be produced conservative, while the authors of the other schemes that had been submitted were taking unwarranted risks and were unduly optimistic. The Corporation proposed to retain the Pigeon House generating station as an auxiliary. Its capacity was 30 to 40 million kWh per annum. Evidence was also given regarding the value of Corporation stock and the financing of the electricity scheme. In the event of the Government not moving in the matter of Liffey power, Mr. J. J. Murphy, Town Clerk, said the Corporation thought it should undertake the scheme rather than leave it to private enterprise, but if the Government decided to take it up, the Corporation would give every assistance. The scheme would take five years to complete. The inquiry was further adjourned.

Malvern.—LOAN.—The Urban District Council has applied for sanction to a loan of £2,000 for transformers.

Middlesbrough.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking for the year ended March 31st last shows a total income of £68,529, as compared with £60,337 in the previous year. Working expenses totalled £36,175, as against £33,950, leaving a gross profit of £32,354 (£26,387). After providing for capital charges and contributing £5,000 to the borough fund, there was a surplus of £212. The capital expenditure during the year amounted to £16,126, the chief item being £13,734 for mains and services. The sales of electrical energy increased from 6,600,407 to 7,435,734 kWh.

Nottingham.—NEW POWER STATION.—Satisfactory progress is being made with the erection of the new power station, which will include plant of a capacity of 30,000 kW, and it is reported that the station will be formally inaugurated on September 24th.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

LOUGHBOROUGH.—Power: A decrease of approximately 10 per cent.

CHESTERFIELD.—Electricity used in billiard halls, theatres, and kinemas: From 5d. to 2½d. per kWh net.

WEYMOUTH.—Cooking: From 2d. to 1½d. per kWh.

FALMOUTH.—*Electric Supply Corporation, Ltd.*—Lighting: From 10d. to 9d. per kWh.

WIMBLEDON.—Street lighting: From 2½d. to 2d. per kWh.

Rotherham.—ELECTRICITY CHARGES.—The Town Council has approved the Electricity Committee's proposal that after the March readings domestic consumers of electricity shall have the option of purchasing a supply on the basis of an annual payment calculated at the rate of 10 per cent. of the net rateable value of the premises, plus ½d. per kWh consumed, with an addition under the two heads at the rate of 30 per cent., as a post-war charge.

Rye.—ELECTRICITY SUPPLY.—At a recent meeting of the Town Council it was reported that Messrs. Crompton and Co., Ltd., had invited the Electricity Supply Corporation, Ltd., to lay down the plant and provide capital for the proposed electric lighting scheme. The Electricity Committee recommended that, subject to the provisional area being agreed, the terms for carrying out the scheme be accepted, it being understood that the maximum price would be 1s. per kWh, but that the charge to be made was not likely to be more than 10d. As the Hastings Corporation has prepared an extension scheme and proposes to include Rye in its area of supply, the whole question was adjourned for further consideration.

Skegness.—PROPOSED ELECTRICITY SCHEME.—The Urban District Council has interviewed Mr. A. H. Seabrook in connection with a proposed electricity scheme for the town. Mr. Seabrook estimates that the capital outlay on the scheme would be £15,000, and that an additional £5,000 would be required for cable extensions, &c., during the first two or three years.

Mr. W. B. Cownie, managing director of the National Electrical Construction Co., Ltd., on February 11th placed before the Council a scheme for supplying electricity to the town from the company's power station at Boston by means of an overhead cable. He estimated the cost at £20,000, and said that his company was prepared to supply electricity in bulk or to find capital to carry out the whole scheme provided the Council co-operated in securing the necessary powers.

Sleaford.—PROPOSED NEW PLANT.—At a recent meeting of the Electricity Committee the electrical engineer reported that he had obtained particulars of various types of plant and made a statement as to the estimated cost of the generation of electricity by steam, as compared with oil engines. It was resolved that in the preparation of his estimate for submission to the Council the engineer should provide for the adoption of oil engines. As an extension of the existing building would be necessary whichever scheme was adopted, it was resolved that the surveyor be instructed to prepare a plan of the site and drawings, &c., of the proposed new building, together with an estimate of the cost, and the engineer was instructed to prepare a complete estimate of the cost of installing the new plant.

Southend.—NEW PLANT.—The Town Council has received a report from Messrs. Handcock & Dykes supporting the recommendation of the borough electrical engineer for the continuance of the use of Diesel engines at the power station, and has decided to install two further Diesel engines to meet the increasing demand.

Special Orders. — Applications have been made to the Electricity Commissioners for Special Orders to supply electricity in the following districts:—Stanley (Durham) by the Urban District Council; Crediton (Devon), by the Urban District Council. Urban District of Stow-on-the-Wold, Rural Districts of Tewkesbury, Winchcomb, Marston Sicca, and Pebworth, and certain parishes in the Rural District of Campden (in the County of Gloucester), and the Rural District of Alcester and certain parishes in the Rural Districts of Stratford-on-Avon and Brailes. All by the Shropshire, Worcestershire and Staffordshire Electric Power Co. (in the County of Warwick).

Sunderland.—LOANS.—The Corporation is applying for sanction to borrow £7,414 for extending mains and switchgear, and £6,661 for laying additional e.h.p. mains. Application will also be made to the Unemployment Grants Committee for a grant towards the cost.

Truro.—ELECTRICITY SUPPLY.—At a recent meeting of the City Council a letter was read from the Cornwall Electric Power Co., stating that if the Council would give its support, the company, in conjunction with Messrs. Edmundsons Electricity Corporation, Ltd., would form a company to supply Truro. The letter intimated that in that event the company would apply for a new Order, containing a clause revoking the existing Order, and that a supply would be available within a few months of the new Order being granted. The

matter was referred to the Electric Light Committee. A meeting will probably take place with the representatives of the company at an early date.

Torquay.—ELECTRICITY AGREEMENT.—In connection with the scheme for providing a bulk supply of electricity for Paignton, the Electricity Committee reports that the Paignton Electric Light & Power Co. has approved the draft heads of agreement, subject to certain minor alterations, and the Committee recommends that the Finance Committee apply for sanction to a loan of £10,000 to cover the cost of the main necessary for affording the supply.

Wakefield. — LOANS. — The Corporation is applying for sanction to loans of £10,000 for mains, and £5,000 for services.

Tramway and Railway Notes.

Bournemouth.—NEW POWER STATION PLANT.—The Town Council has received sanction to install the following plant at its tramway power station:—Two 750-kW sets; two water-tube boilers, with necessary auxiliary plant. The cost of the extensions is estimated at £5,000.

Continental.—POLAND.—A number of contracts have been accepted for an extension of the Warsaw suburban electric railway to Zyrardow, and the first part of the work is to be completed by the summer of 1926.—*The Times.*

GERMANY.—At the last sitting of the Essen Chamber of Commerce a project was discussed for an express electric train service between Cologne and Dortmund. The capital required is 300,000,000 marks, and it is understood that the large towns on the route, the local authorities, and industrialists will be willing to subscribe it. It is hoped that a speed of 120 km. per hour will be attainable, so that the journey from Cologne to Dortmund will occupy only 1¼ hours instead of 2½ hours as at present by express train.

At a recent meeting of the German Association of Architects and Engineers in Berlin, it was stated that work is approaching completion on the electrification of the Munich-Garmisch line, and financial credits have been secured for the conversion of the Munich-Rosenheim-Kufstein section. The projected electrification work in 1926 includes the Halle-Magdeburg and the Munich-Ratisbon lines, while at a later date it is intended to convert the Munich-Berlin lines *via* Probstzella and Hof.

HOLLAND.—In the recently-issued report of the Société des Tramways de Rotterdam, it is stated that during the past year the extension of the No. 15 line as far as Spangen was completed and opened for traffic, and that several of the other lines have also been extended to outlying districts. The traffic receipts, however, declined from 6,391,005 guilders in 1922-23 to 5,665,987 guilders last year, this being attributed to the severe competition by privately-owned motor 'buses. The directors of the associated concern, the Flushing-Middelbourg Electric Light and Tramways Co., also report a decreased traffic owing to motor-'bus competition, the receipts showing a falling off of 28,291 guilders, which was, however, more than counterbalanced by an increase of 44,353 guilders in the receipts from lighting supply.

SWITZERLAND.—A return just issued by the Swiss Federal Railway authorities in Berne shows that there are now in service on the system 167 electric locomotives, 17 accumulator vehicles, and 16 combined electric locomotives and carriages.

SPAIN.—Application has been made for a concession to extend the Madrid underground railway (Metropolitano Alfonso XIII) from Estrecho to Tetuan.

Liverpool.—TRAMWAY FARES.—In connection with the Tramways Committee's proposal to increase the tramway fares for journeys exceeding 4½ miles, the City Council has postponed consideration of the recommendation until the end of the financial year.

London.—SHEPHERD'S BUSH STATION.—The work of reconstructing the Shepherd's Bush underground station is now almost complete. The station caters for an annual traffic of 6,000,000 passengers, and the improvements made will add another 50 per cent. to its capacity. The lifts have been replaced by escalators of reversible type, and the Passimeter system has been installed.

Middlesbrough.—YEAR'S WORKING.—The accounts of the Corporation tramway undertaking for the year ended March 31st last record a total revenue of £64,547, as compared with £62,337 in 1922-23. Working expenses amounted to £45,622, as against £49,564, leaving a gross profit of £18,924 (£12,773). After deducting capital charges, there was a net deficit of £3,847, as compared with a loss of £10,304 in the previous year. The number of passengers carried increased from 9,677,202 to 10,551,743.

Sunderland.—FARES.—The Town Council has adopted the recommendation of the Tramways Committee to restore pre-war fares on April 1st. Nearly all 1½d. fares will be reduced to 1d., and workmen's fares will be abolished.

Telegraph and Telephone Notes.

Hungary.—TELEPHONY.—It is reported from Zagreb (Agram) that a modern telephone exchange is to be established in that town.

Italy.—NEW TELEGRAPH CABLE.—The cable between Porto d'Auzio in Italy and Malaga in Spain, which links Italy with New York, is reported to have been completed on February 10th.

Mexico.—TORREON TELEPHONE SYSTEM.—The State Government of Coahuila has granted the Torreon firm of Figueroa y de la Mora a concession to construct and operate a telephone system in the city of Torreon for 20 years. It may also extend the lines to any part of the State. The company, says *Commerce Reports*, has not decided whether it will do its own construction work or let a contract to a construction company. It is expected that exchanges will be constructed at Torreon, Matamoros, and San Pedro in the State of Coahuila, and at Gomez Palacio, and Lerda, Durango. Underground cables will be laid in the business district of Torreon, and it is estimated that from 800 to 1,000 telephones will be installed.

Poland.—TELEPHONE WORKS.—It is reported that the Polish Government has decided to dispose of the State telephone works at Warsaw to a private undertaking.

Transatlantic Cables.—NEW PROJECT.—Before sailing in the *Olympic* Mr. Newcomb Carlton, the president of the Western Union Telegraph Co., announced that the company intended to lay a cable costing five million dollars from England to America. The section to be laid this year would be from England to Newfoundland, and the stretch down the coast would be laid in 1926. He said the cable would have a capacity of sixty million words annually.—*Reuter* (New York).

According to the *Financial Times*, the new cable will be of the "Permalloy" type, and the Penzance-Bay Roberts section is being manufactured in this country.

Tanganyika Territory.—NEW RADIO STATION.—According to the *British South African Export Gazette*, the erection of a large radio telegraph station at Dar-es-Salaam is to be considered by the Secretary of State for the Colonies.

The Telephone Service.—STORM DAMAGE.—G.P.O. engineers have been kept very busy repairing the damage done by gales to telephone and telegraph lines recently. Dublin was completely cut off at one time, and there were long delays in telephoning to South Wales. Fifteen of the lines to Manchester were out of action, 11 to Liverpool, nine to Birmingham, six to Cardiff, three to Rugby, and two to Swansea. Of the Continental lines, five to Paris were out of action out of 15, one to Brussels out of four, and one to Antwerp out of three. The only Boulogne line was down, but communication was possible from London *via* Paris. The London service was affected, and at one time 218 out of the 800 trunk lines were out of order.

Radio Notes.

Agricultural Broadcasting. — WEEKLY BULLETIN.—The British Broadcasting Co., in conjunction with the Ministry of Agriculture, has arranged to broadcast a weekly bulletin giving latest foodstuff and market intelligence each Thursday evening from 6.35 to 6.40 p.m.

Austria.—CONTROL SIMPLIFICATION.—The boom has provoked agitation for a simplification of radio control and for the elimination of the "radio-control cards." At present the card is required only in case of the sale of a complete set, a loud speaker, or headpiece. Observance of the regulations involves materially increased selling costs, says *Commerce Reports*, and modification of the present regulations is sought. About 60,000 sets are estimated to be in operation. Retail distribution of radio equipment in Austria has not yet been organised. The number of dealers is estimated at 400. Radio sets and parts are displayed for sale by all sorts of stores in Vienna, ranging from barber and perfumery shops to stores dealing in scientific instruments. This condition leads to misrepresentation and to public dissatisfaction. In many cases manufacturers are seeking to sell direct to the consumer.

Belgium.—SUBSCRIPTION SCHEME.—To increase the variety and extend the scope of its programmes, the Brussels broadcasting station recently issued an appeal to all listeners to become subscribers. The *Daily Mail* explains that a scheme has been devised by which, according to means, listeners could become subscribers or effective or honorary members. So largely have Belgians supported their national station that projects held up for lack of funds are to be put into practice at once. Subscribers are also to have the right of suggesting improvements.

Broadcasting Plays.—DIRECTOR OF PROGRAMMES.—In response to an invitation from the British Broadcasting Co., Mr. George Grossmith has accepted the appointment of advisory director of programmes. The company hopes that the

appointment will further develop the liaison with the entertainment industry which the present negotiations have commenced. Mr. Grossmith, says the *Daily Telegraph*, has, in fact, been acting as an unofficial adviser to the B.B.C. since the beginning of the year.

NEGOTIATING COMMITTEE.—At a meeting held on February 12th the negotiations between the British Broadcasting Co. and a sub-committee appointed by the entertainment industry were fully discussed by all the theatrical interests represented. So far the conversations between the managers and the B.B.C. have been private, but it has been announced that an amicable spirit has pervaded all the discussions, and that there is a good prospect of a satisfactory agreement being reached on all the points in dispute. The Joint Broadcasting Committee, representing the fourteen sections of the entertainment industry, empowered the sub-committee to act on its behalf in drawing up the terms of the agreement with the B.B.C. at the next meeting, to be held shortly, says the *Morning Post*. Though there is every prospect of an early settlement being reached between the theatres and the B.B.C., it is by no means improbable that the concert-givers and music publishers may remain outside the agreement which, it is believed, will shortly be reached. The variety artists, too, are in rather a peculiar position. Every artist may require to make a special arrangement, because, in a sense, he is often his own author, composer, and manager. Mr. W. Payne, chairman of the sub-committee, also hinted at the possibility of theatrical employés, stage hands, and other technical workers sharing in any profits that might accrue from the broadcasting of a play.

Licences.—DEMAND MAINTAINED.—It is reported that the number of new licences for the use of receiving apparatus issued during the month of December, 1924, amounted to 58,000.

Norway.—BROADCASTING COMPANY.—A broadcasting company has been established at Oslo (Christiania), and will begin working in a few days in conjunction with the Marconi Co.

Poland.—REGULATIONS.—A decree is in course of preparation indicating the conditions under which the sale of radio apparatus will be permitted in Poland. According to the terms of this decree, "inlaid made single apparatus" will be subject on sale to a tax of 5 per cent.; assembled apparatus will pay 10 per cent.; and imported articles of foreign manufacture 20 per cent.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of:—

Electric glossing irons for the boot and shoe trade.
Thermostatic strip metal in quantity.
MOTORA or other piano player motors.
LEEDS lamp lock.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Ashford (Kent).—February 23rd. Electricity Department. Three 400-kW, 3-phase alternators, and 15 e.h.p., 6,600-V switchgear cubicles. (February 6th.)

Australia.—SYDNEY.—March 30th. Municipal Council. Maximum demand indicators.*

April 2nd. Postmaster-General's Department. Accumulator batteries and parts.

MELBOURNE.—March 4th. Victorian Government Railways. Telephone equipment.*

April 1st. Electrical equipment for motor coaches and trailers.*

One 15-ton electric travelling crane.

Postmaster-General's Department. March 10th. Primary battery parts.*

April 7th. Commonwealth P.M.G.'s Department. Wall and table telephone sets. (February 13th.)

Belfast.—February 28th. Electricity Committee. Stores for 12 months, including electrical accessories, lamps, carbon brushes, meters, cables, &c. (February 6th.)

Belgium.—March 9th. Limbourg Provincial authorities at Hasselt. 50 potential transformers.

April 14th. Société Nationale des Chemins de Fer Vicinaux, 14, Rue de la Science, Brussels. Electric feeder cables for the local railways between Antwerp-Wommelghen, between Antwerp and Wyneghem-Schilde, and between Merxem and Schootenhof. Particulars for 3 fr. from the Bureaux des Services Electriques, 48, Rue Montoyer, Brussels.

Birmingham.—February 28th. Tramways Committee. Traction motors, power wiring, &c., for 30 tramcars. Particulars from Mr. A. C. Baker, chief engineer, Corporation Tramways, Birmingham.

Cockermouth.—Cottage Hospital Committee. Electric lighting installation at the hospital. (February 13th.)

Darlington.—February 25th. Electricity Works. Trolley omnibuses and reconstruction of overhead equipment. (February 6th.)

Edinburgh.—March 14th. Corporation. Installation of additional electric lighting and power circuits at the slaughterhouses and cattle market, Gorgie. Specifications from Engineer, Dewar Place.

February 28th. Lighting Department. Cast-iron pillars (approx. 2¼ cwt.).

March 9th. Electricity Supply Department. E.h.p. switchgear and 3-phase transformers. (See this issue.)

Egypt.—CAIRO.—March 1st. Superintendent of Stores, Egyptian State Railways, Telegraphs and Telephones, Bulaq, Cairo. Supply of 13,200 metallic-filament lamps. Specification from the Stores Department, Saptia, Cairo, or Gabbary, Alexandria.—*Reuter's Trade Service* (Cairo).

Grimsby.—February 23rd. Electricity Department. Street lighting, posts and fittings. (February 13th.)

India.—March 3rd. India Store Department. Accumulators for train lighting.

March 17th. Electric generating sets and switchboards. (See this issue.)

February 25th. Burma Railways Co., Ltd. Induction motor and starting pillar. (February 13th.)

Kettering.—March 4th. Electricity Department. Two miles h.p. and 7 miles l.p. l.c. s.t. cable. (See this issue.)

Leeds.—March 3rd. Tramways and Highways Department. Materials, including electrical sundries, copper bonds, electrodes, &c. Particulars from Purchasing Section, Head Office, Leeds.

London.—KENSINGTON.—March 5th. Board of Guardians. New internal telephone installation for the Marloes Road Institution. (February 13th.)

METROPOLITAN ASYLUMS BOARD.—February 25th. Alterations and additions to the fire alarm installation at Long Reach (Smallpox) Hospital. (February 13th.)

Madagascar.—March 27th. Madagascar Post and Telegraph authorities at Tananarivo. Eleven "standard" telephone tables and one for inter-urban telephone lines. Particulars from the Office Nationale du Commerce Extérieur, 22, Avenue Victor Emmanuele III, Paris.

Manchester.—February 24th. Tramways Committee. Copper and bronze trolley wire. Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly.

Plymouth.—February 27th. Electricity Department. Sub-station switchgear, Scott-connected transformers and feed pump. (See this issue.)

Portsmouth.—Electricity Department. One 6,000-kW turbo-alternator, with condensing plant, two 30,000-lb. per hour capacity water-tube boilers, with steel bunkers and economisers. (February 6th.)

Salford.—February 23rd. Electricity Department. One 1,500-kW rotary converter, with transformer and starting gear complete. (February 6th.)

South Africa.—JOHANNESBURG.—April 6th. South African Railways and Harbours. One 5-ton and three 4-ton electrically-operated portal cranes.*

Stoke-on-Trent.—March 10th. Electricity Department. 12 months' supply of mains and cables, a.c. and d.c. meters, sub-station switchgear and static transformers. (See this issue.)

South Shields.—February 25th. Electricity Supply Department. One 1,000-kW rotary converter, with transformer, &c. (February 6th.)

Torquay. — February 28th. Electricity Department. Steam, feed, exhaust, drain and other piping for Newton Abbot power station. (See this issue.)

Wigan. — February 23rd. Tramways Department. Scraping and painting the tramway standards. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

(*Continued on page 303.*)

The World's Largest Engineering Project.—III.

The Undertaking of the Southern California Edison Co.

By T. B. ROSS.

(*Continued from page 272.*)

Camp Life in the Mountains.

To cater for the needs of 5,000 men in a mountainous country with the nearest town about 80 miles away is a proposition of some magnitude, especially when one considers that many of this number are spread out over a 30-mile front, some parts of which are entirely cut off by the snow for six or more months of the year. This part of the company's project calls for much forethought and clever organisation, and the company is to be congratulated on the capable and efficient manner in which it handles the matter.

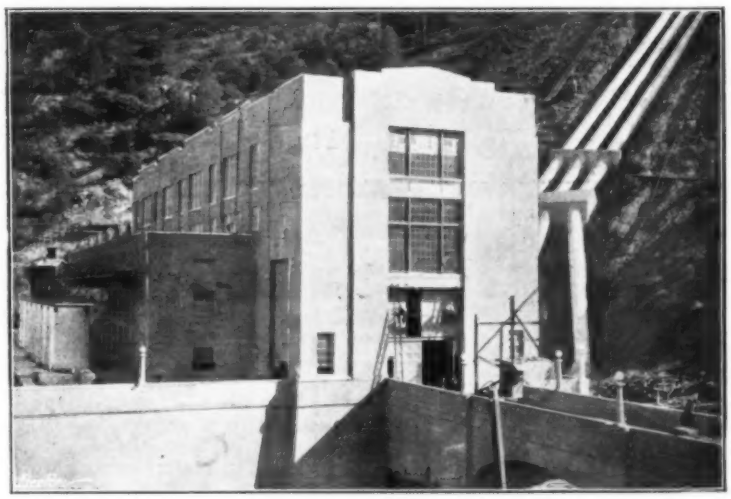


Fig. 1.—Power House No. 3, Big Creek.

Living accommodation, food, medical service, sanitation, amusement, &c., all have to be given full attention if the men are to be kept on the job and in a peaceful state of mind. Naturally, the life is rough, and as most of the workmen are only transients representing many nationalities, the officials responsible for camp organisation are at times hard put to it to keep the men contented.

All operations are conducted from the headquarters camp at Big Creek, which at some periods will have to provide living quarters for men, their wives and families to the number of 2,000 and upwards in Big Creek alone. The married men with their families are, as far as possible, accommodated in the many small houses built by the company; single men, of the salaried class, live in bungalows each containing about 20 or more two-berth cabins; and the labourers and day workers live in the usual camp bunk-houses. Practically all the buildings are constructed of wood supplied by the company's own mill beyond Huntington Lake. The mess hall, which will accommodate probably 500 or more men at one sitting, is fitted with the latest American cooking stoves designed for camp purposes, being heated by oil distillate under gravity pressure.

Three meals a day are served to those engaged on daily work at the following hours:—7.15 a.m., 12.15 p.m., and 5.30 p.m. Special arrangements are made for the night shifts. There is a big variety of food and as much as any man wants to eat. In fact, in the writer's opinion, there is an unnecessary surplus at all meals, with consequent waste. The company runs its own stock farm up in the mountains and, generally speaking, the meat supplied is exceptionally good. The catering department has naturally to rely, to a large extent, on "canned" vegetables and preserved fruits, but, where possible, fresh food is supplied. There is no distinction of class when taking one's seat at table, although most of the regulars and "old-timers" manage to sort themselves into their own little groups. To one interested in the study of humanity, a place such as the Edison Mess Hall is an ideal hunting ground—Ameri-

Fig. 2.—Shuteye Peaks and San Joaquin River.

Fig. 3.—Railway to Fresno in Winter.

Fig. 4.—Pitman Falls and Power House No. 1, Big Creek.

cans from almost every State in the Union, foreigners from all over Europe, Canadians, Scotchmen, men from Ireland and Wales, and a few from England—all are to be found seated round those long Edison "feeding-boards." Imagine a horde of hungry, hefty fellows surging round the mess-hall door at 5.29 any evening, all jostling and joking together. Another minute and "Old John" (a famous and popular character known to all Edisonites) picks up his steel bar to start the gong sounding throughout the camp. The double doors fly open and the rush commences. Those in first get the hottest meat and vegetables. In one minute all except the few stragglers are seated, and then the din begins. If you expect to eat anything there you must forget your British table etiquette and manners and, like those around you, "use your voice." Dishes of meat, vegetables, &c., pass up and down the tables while the stranger is wondering what he will eat, and by the time they come his way again they are empty and whisked off by the "flunkies" to the kitchens to be replenished. But a little patience and, after the "hungry wolves" have got their share, the quiet ones get a chance. I and some of my camp pals from home had often only just started a meal when the "roughnecks" were leaving their seats after a hearty and full meal. Americans are, I should say, the fastest eaters in the world. Five minutes is ample for some of them to consume a meal sufficient to serve three Englishmen. From the fall of the flag until the finish, the average American workman never stops, and his methods of manipulation are in some cases somewhat rough and ready.

Fig. 5.—Dam No. 6.

Fig. 6.—Rainbow Falls.

As is only to be expected, most men in camp are known by some nickname or other—"Red," "Slim," "Shorty," "Scotty," "Tony," &c. I received mine during the first meal I had in camp. It was at breakfast on a rather cold day. A few seats away from me was a large dish of hot steaming porridge, which I politely asked one of my neighbours to pass to me. About a dozen around me heard my request without, however, any of them attempting to assist me. I again asked a man sitting on the opposite side of the table to "please pass the *porridge*." At last one of the crew sang out, "Pass English the *mush*," and from that hour I was known as "English" to all who did not have to meet me except on odd occasions. But for all their faults and somewhat uncouth manners, at heart the majority of the men were decent fellows and would gladly do anything to help any strange "guys" in getting to know their new surroundings.

Many of the casual workers join the company intending to stay only a few months, or long enough to make a "stake" with which they will return to the cities and seek more congenial work.

(To be concluded.)

Fig. 7.—Meadow near Mono Ranger Station, which will become a Reservoir.

Fig. 8.—Blaney Meadow, South Fork, on San Joaquin River.

Fig. 9.—The Dome at Big Creek.

Fig. 10.—Devil's Post Pile.—Peculiar Rock Formation.

The Philips Electric Lamp Works.

A Large Dutch Undertaking.

AMONGST the electric lamp factories of the world Messrs. Philip's Glow-lamp Works, situated at Eindhoven, Holland, is one of the most interesting, for two reasons—because it has grown within 34 years to such an extent that it now produces about one-seventh of the electric lamps which are sold annually and used all over the world, and because nearly all these lamps are made in one large factory and not in a combination of different works.

Fig. 1.—Philips's Glow-lamp Works, Eindhoven.

In one building, fig. 1, 7,500 men and women are now employed in lamp making, using the most modern processes and automatic machinery, and acting under the supervision of a permanent staff of more than 100 engineers, physicists, and chemists. A quarter of a million lamps leave the factory every day, and are shipped to all parts of the world.

It may readily be imagined that considerable quantities of glass, tungsten, packing material, &c., are needed: to secure a regular supply and good quality these materials should be made in the firm's own factories, and this consideration led to the establishment, in 1916, of Philips's glass-works, figs. 2 and 3, close to the glow-lamp works. The glass-works have since been extended, and now comprise 12 furnaces, 1,500 men being engaged in blowing the bulbs, and in making the glass tubes and cane-glass (more than 150 miles per day) used in the manufacture of incandescent lamps. The nearness to each other of these two works has stimulated close co-operation between the scientific and technical staffs of both, resulting in important improvement in the art of glass-manufacture, such as the white "Argenta" bulbs, which are now made in all sizes up to 500 watts

Fig. 2.—Interior of Glass Factory.

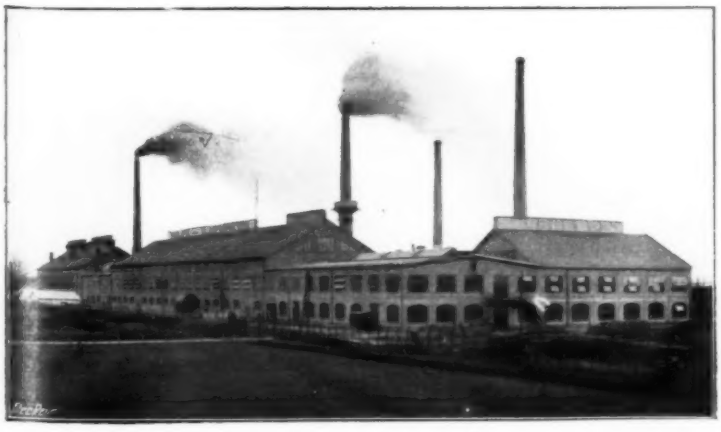


Fig. 3.—Exterior of the Glass Works.

with a low absorption of light. In the very year in which the tungsten filament was introduced, Philips's Glow-lamp Works started a chemical department in which tungsten could be produced from the ore in the high degree of purity which is essential to ensure a long-life and shock-proof lamp. The quantity of tungsten-wire which is annually produced would be sufficient to reach three times around the earth. The wire is drawn down to 0.0004 in. for small high-voltage lamps, as well as to a diameter of 0.04 in. and more for the stout spirals of big stereopticon, kinema, and lighthouse lamps. Lamps of 1,000 watts are the standard type for lighthouses, and tests are in progress with lamps of 10,000 watts.

Large quantities of different gases are consumed in the manufacturing processes of incandescent lamps. The

furnaces of the glass works are heated by gas, about 50 tons of coal being used per day for this purpose. The blow-pipe is the most important tool in lamp making, and many thousands of these flames, fed by gas and compressed air or oxygen, are employed for cutting, bending, piercing, and fusing the different glass parts which together form so large a proportion of the constituents of an incandescent lamp.

Hydrogen is chiefly used for chemical purposes, *e.g.*, the reduction of tungsten-oxide, and this gas is produced by a 300-kW electrolytic plant. For the production of oxygen and nitrogen a plant has been set up with a capacity of 1,200 litres of liquid air per hour. By distilling the liquid air the nitrogen is separated from the oxygen, the nitrogen being produced only for the sake of the small quantity of argon that it contains, which is fully recaimed. The value of this rare gas, as well as that of neon, has greatly increased on account of the results obtained from their application to electric lamps.

Fig. 4.—Street View in Philips Town, Holland.

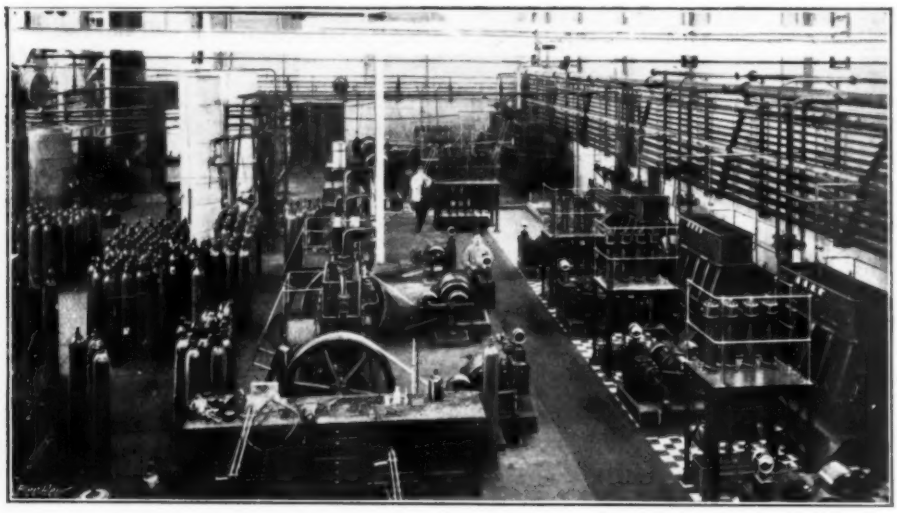


Fig. 5.—Interior of Argon Gas Factory.

The power plant has an average load of 3,000 kW. The energy is used for supplying 1,600 motors, individual drive being applied to all automatic machines, for lighting the works, and for the life-tests of lamps, as well as for the preparation of tungsten.

Scientific research has yielded remarkable results in the improvement of lamp quality, and in the development of new applications of the principles of lamp-making: X-ray tubes, high-pressure rectifiers and radio-valves have during the last year become important products of these works. Water-cooled transmitting valves of 25 kW are a standard product.

A staff of scientists are engaged upon research work in a special laboratory building of 30,000 sq. ft., which offers accommodation for 20 research workers and their assistants. Contact with the scientific world is maintained by a very complete library, and by weekly meetings where scientists of international fame, amongst them Einstein, Langmuir, and others, have lectured. The work done at the physical laboratory is completed at the experimental plant, where new manufacturing processes can be worked out from the practical side, and made suitable for use in the lamp works proper. All machinery needed for the lamp and glass works is made on the premises in the engineering department, which employs about 700 workmen. The automatic machinery used in different stages of the manufacturing processes is of a very intricate character, and independence of outside suppliers guarantees quick construction and secrecy in detail. The engineering staff of this machinery department are in constant touch with the staff of the lamp works, so that they can watch their own machines at work, and have every facility for testing the improvements they suggest.

Perfect machinery and careful control of the product alone do not ensure high quality. The ability and zeal of the workers are equally important and, therefore, the management has created many institutions for the welfare of the workmen and their families, in order to promote a good spirit. First may be mentioned the different schools, offering educational facilities to employés, as well as to

Fig. 6.—High-Voltage Spark Apparatus.

their children; for boys and girls the works established elementary schools and large playing grounds. In a special school those who want to enter the works receive instruction in lamp making and its machinery; evening classes are provided to complete the education of the younger men in the works, the classes covering mathematics, physics, chemistry, machine drawing, foreign languages, correspondence, and accountancy. The girls are taught cooking and sewing.

Eindhoven being a small town, the lack of suitable houses for the rapidly increasing number of employés was met by building Philips Town, fig. 4, where 1,500 dwellings are leased to workmen at a very moderate rent. Most of the houses have a supply of gas and electricity, and a bath room. Spacious gardens separate them, and the streets are not all laid out in straight lines, thus avoiding the monotony which often characterises workmen's quarters. There are big sports grounds, and grocery, bread, and meat stores are run by a co-operative organisation of the workers.

Free medical treatment is afforded, and two physicians with a large staff of nurses and midwives look after the health of the workers and their families. The medical department is fully equipped with apparatus for the treatment of diseases and accidents, including an X-ray installation.

Those desiring to enter the works are not only subjected to a medical test, but are also examined in the department of psychotechnics. By a series of simple tests on mental and physical efficiency, which are made within an hour, the suitability of the candidate for a certain class of work is ascertained. Thus, the necessity of a workman being moved from one department to another until he gives satisfaction, or has to be dismissed as incapable, is avoided.

A system of co-partnership has been established to interest the employés and foremen in the development of the works. Part of the annual bonus is given in the form of shares. A pension-fund is provided for the widows and children of the employés; workers are also entitled to a pension when they retire at the age of 60.

It will readily be understood that the welfare work briefly described above is of great benefit to all, and that it promotes a good spirit between the management and the workers, evidence of which is the fact that no strike has ever interrupted regular production.

Contracts Open and Closed

(Concluded from page 298.)

Closed.

Australia.—MELBOURNE.—Victorian Railways. Accepted:
One 7-ton electrically-driven travelling Goliath crane.—Lascelles, Parrington, Ltd., agents for J. M. Henderson & Co. (Aberdeen).

Postmaster-General's Department. Accepted:—
Jointing sleeves (£1,301).—W. F. Dennis & Co., Ltd.
Transformers (£8,768).—Western Electric Co., Ltd.
Switchboards.—British L. M. Ericsson Tel. Mfg. Co., Ltd. (£27,043); Western Electric Co. (Aust.), Ltd. (£10,080).
Switchboard plugs.—British L. M. Ericsson Tel. Mfg. Co., Ltd. (£2,641); British General Electric Co., Ltd. (£1,841).
Cords.—Siemens Bros. & Co., Ltd. (£558); Western Electric Co., Ltd. (£12,103).
Submarine cable.—Siemens Bros. & Co., Ltd. (£401); British Insulated and Helsby Cables, Ltd. (£277); W. T. Henley's Telegraph Works Co., Ltd. (£230).
Telegraph equipment.—Siemens Bros. & Co., Ltd. (£1,341); Walters Electric Mfg. Co., Ltd. (£1,051).
Lamp sockets (£358).—British General Electric Co., Ltd.
Lamp caps and sockets (£238).—Siemens Bros. & Co., Ltd.
Switchboard lamps (£1,256).—Noyes Bros. (Melb.) Pty., Ltd.

State Electricity Commission of Victoria. Accepted:—
Transformers (£1,741).—Weymouths, Ltd.

LIVERPOOL (N.S.W.).—Electricity supply scheme.
Outdoor distribution transformers (£756).—English Electric Co. of Aust., Ltd.
Switchgear, d.c. transformers, street-lighting fittings, &c. (£2,280); poles, cross-arms, cables and all outdoor reticulation (£9,880).—Lawrence and Hansen Electrical Co., Ltd.
House-service meters (£589).—Electricity Meter Mfg. Co., Ltd.

BRISBANE.—City Electric Light Co., Ltd. Accepted:—
Steam turbines and generators.—British General Electric Co., Ltd.
Condensing plant.—W. H. Allen, Son & Co., Ltd.
Boilers, draught plant, and chimney.—Babcock & Wilcox, Ltd.
Economisers.—E. Green & Son, Ltd.
Switchgear.—British Thomson-Houston Co., Ltd.
Transformers.—Australian Westinghouse Electric Co., Ltd
Underground cables.—British Insulated & Helsby Cables, Ltd.
Storage batteries.—Tudor Accumulator Co., Ltd.
60-ton overhead crane.—J. Carrick & Sons.
Water screening plant.—F. W. Brackett & Co., Ltd.
Constructional steelwork.—Harvey & Sons and Sydney Steel Co., Ltd.
Power-house foundations, &c.—T. Rice.
The total amount of the tenders is £290,000.—*Tenders.*

SYDNEY.—New South Wales Government Railways. Accepted:—
Supply of electrical material (£417,716).—Metropolitan-Vickers Electrical Co., Ltd.—*Reuter's Trade Service* (Melbourne).

Barnsley.—Electricity Committee. Recommended:—
Battery booster (£181).—Metropolitan-Vickers Electrical Co., Ltd.

Basingstoke.—Electricity Committee. Recommended:—
600-kW Diesel generating set (£9,964).—Mirrlees, Bickerton & Day.

Carlisle.—Electricity Committee. Accepted:—
Deaerating and evaporating plant (£4,318).—Mirrlees, Bickerton & Day.

Dumfries.—Town Council. Accepted:—
Installing electric light in 48 houses.—Mr. Erskine (20 houses, £92); South of Scotland Co. (28 houses, £66).

Dundee.—Harbour Board. Accepted:—
16 Lancashire "Maxtorq" motors for the four cranes to be installed by Messrs. Higginbottom & Mannock.—Lancashire Dynamo & Motor Co., Ltd.

Isle of Thanet.—Messrs. John Thompson Water Tube Boilers, Ltd., have received a repeat order from the Isle of Thanet Electric Supply Co., Ltd., St. Peter's, Kent, for one of their patent vertical straight tube type water-tube boilers, suitable for 40,000 lb. evaporation, 220 lb. working pressure, complete with superheater, &c.

Keighley.—Corporation. Recommended:—
Duplicate overhead transmission line from Ingrow to Oakworth (£685).—Electric Construction Co., Ltd.

London.—ST. PANCRAS.—Electricity and Public Lighting Committee. Recommended:—
Water-softening apparatus (£1,605).—W. Boby & Co.

STOKE NEWINGTON. — Electricity Committee. Recommended:—
Completing the electrical installation in the new electricity offices and showroom building (£136).—J. H. Golding.

Margate.—Town Council. Accepted:—
Installing electric light at the Wingham waterworks pumping station, including steam engine, dynamo, battery, and switchboard (£312).—Robey & Co., Ltd.

Sevenoaks.—Board of Guardians. Accepted:—
Wiring the Institution at Sundridge for light and power with solid drawn steel tubing (£1,056).—Read & Partners.

Sheffield.—Corporation. Accepted:—
Erection of a transformer sub-station on the Manor housing estate (£1,167).—James Lover & Sons, Ltd.

South Africa.—CAPE TOWN.—Electricity Department. Accepted:—
11,600 yd. .666 sq. in. 3-core cable (£6,535).—Telegraph Mfg. Co., Ltd.

Sunderland.—Corporation. Accepted:—
Evaporating plant.—P. & B. Evaporators, Ltd.
Switch equipment.—General Electric Co., Ltd.
Blow-down receiver.—Vickers-Spearing Boiler Co., Ltd.

Torquay.—Electricity Committee. Accepted:—
Boiler-house plant (£16,535, plus £171 for Bennis coal-handling plant, and £358 for Detrick furnace arches).—Stirling Boiler Co., Ltd.

Wakefield.—City Council. Accepted:—
6,000-kW turbo-alternator set, with condenser and auxiliaries (£24,906).—English Electric Co., Ltd.

Weymouth.—Town Council. Accepted:—
500 yd. of distributing cable and 500 yd. of service cable (£314).—Johnson & Phillips, Ltd.

Forthcoming Events.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, February 23rd. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "The Electrical Journals, Past, Present and Future," to be opened by Mr. W. E. Warrilow.

(North-Eastern Centre).—Monday, February 23rd. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Paper on "The Design of Electrical Plant, Control Gear, and Connections for Protection Against Shock, Fire, and Faults," by Mr. H. W. Clothier.

(North-Midland Centre).—Tuesday, February 24th. At the Hotel Metropole, Leeds. At 7 p.m. Paper on "The Selection of Ball and Roller Bearings for Electrical Machines," by Mr. T. D. Trees.

(North-Western Centre).—Friday, February 27th. At the Midland Hotel, Manchester. Annual dinner.

(Scottish Centre).—Saturday, February 21st. At the Grosvenor Restaurant, Glasgow. Smoking concert.

(North-Western Students' Section).—Saturday, February 28th. At the Manchester College of Technology. At 7.30 p.m. Paper on "E.h.p. Switching Practice," by Mr. B. Nuttall.

Institution of Civil Engineers.—Tuesday, February 24th. At the Institution, Great George Street, S.W. At 6 p.m. Paper on "The Demolition of the Harbour and Defence Works of Heligoland," by Mr. L. H. Savile.

British Electrical Development Association.—SALESMANSHIP CONFERENCE.—Thursday, February 26th. At Sopwith's Lounge, Newcastle-on-Tyne. Paper on "The E.D.A.—its Aims and Objects," by Mr. V. W. Dale.

Birmingham Electric Club.—Friday, February 27th. At the Grand Hotel, Birmingham. At 7 p.m. Paper on "The Economic Value of Good Electric Lighting," by Mr. W. J. Jones.

Edinburgh Electrical Society.—Friday, February 27th. At the Philosophical Institution, 4, Queen Street. At 8 p.m. Discussion on "The I.E.E. New Wiring Rules."

Manchester Association of Engineers.—Friday, February 27th. At the Engineers' Club, Manchester. Paper on "The Internal-Combustion Turbine," by Mr. T. B. Morley.

Tramways and Light Railways Association.—Friday, February 27th. At Caxton Hall, S.W. At 2.30 p.m. Annual meeting. In the evening the annual members' dinner will be held at the Trocadero Restaurant, to be followed by a smoking concert.

National Physical Society.—Friday, February 27th. At the Imperial College of Science, South Kensington. At 5 p.m. Ordinary meeting.

Junior Institution of Engineers.—Friday, February 27th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "A Treatise on Modern Lighting Practice," by Mr. E. Stroud.

Institution of Mechanical Engineers.—Friday, February 27th. At the Institution, Storey's Gate, S.W. At 7 p.m. Informal meeting—Discussion on "Practical Problems of Lubrication."

Royal Institution of Great Britain.—Saturday, February 28th. At 21, Albemarle Street, W. At 3 p.m. Lecture on "The Counting of the Atoms," by Prof. Sir E. Rutherford, F.R.S.

Notes.

The Electrical Engineers' Ball.—At the risk of appearing to gild the lily, we feel that we have no alternative but to say that last Friday's dance, the twenty-first birthday of the Electrical Engineers' Ball, was perhaps the most successful of the whole series. Those of us who have attended most of the dances since they commenced have become accustomed to the almost inhuman perfection with which every detail of the arrangements has been carried out, but on this occasion several new features were added which contributed enormously to the general gaiety. Coloured projectors were used in combination with a revolving, many facetted mirror, which sent brilliant splashes of colour spinning madly round the darkened ballroom.

Bright-hued balloons appeared in quantity from nowhere and at midnight when St. Valentine's day was at hand, the guests were presented with gay head-gear, added to which for the ladies were a number of wonderful dolls.

We have a sneaking suspicion that some of the committee have been acquiring experience either at the Bal Tabarin in Paris, or in some of the more vivid night clubs of the metropolis, but whatever the source of inspiration, they may be most heartily congratulated on a great success.

During the supper Sir William Noble said a few words with regard to the origin of the dance, and Messrs. A. M. Sillar, J. E. Kingsbury, H. Alabaster, and A. H. Walton briefly replied.

Once again we make no excuse for giving the names of those whose unselfish work, carried on for many months past, has made so complete a success of what has now become one of the largest and most important functions of the year. It was impossible not to feel a touch of sadness in that Mr. Wordingham has passed from among them and from among us. The Executive Committee were: Messrs. O. H. Baldwin, W. S. Lonsdale, A. M. Sillar, R. J. Wallis-Jones, J. E. Kingsbury, P. V. McMahon, C. H. Wordingham, C.B.E., and A. H. Walton. The hon. secretaries were Messrs. Sillar and Lonsdale, and Mr. Kingsbury acted as hon. treasurer.

Somewhat Mixed.—A correspondent sends us the following items taken respectively from the advertisement pages of the *Birmingham Post* of February 11th and the *Birmingham Mail* of February 10th:—

WANTED, Single-faced Electric Motor, 5-10-h.p.; or will Exchange 8-h.p. Double-faced Motor.

ELECTRICIAN; must be competent man and capable of putting in wire installation for gas and power.—State wages and experience.

Local Societies.—ROAD TRAFFIC PROBLEMS.—Mr. W. J. Steele, D.S.O., M.Inst.C.E., City Engineer of Newcastle-on-Tyne, gave an address on "Town Roads" to members of the North-Eastern District, National Association of Local Government Officers, on the 5th inst. In Newcastle the number of tramcars passing a point on the North Road between 6 a.m. and 10 p.m. was 590, he said, and an approximation of the weight of this traffic was 6,500 tons, which, added to the weight of ordinary traffic, gave a total of something like 11,338 tons per day.

Mr. Steele expressed the view that if the tramway had been conceived after the motor-driven vehicle had been in use for some time, it was doubtful if authority would ever have been given to use highways for the tramway. He did not agree that the tramcar was an obsolete vehicle. While the motor omnibus, charabanc, and overhead trolley railless car had developed a high degree of efficiency, they were still incapable of carrying the peak load in the centre of a large industrial town so economically as a tramcar. Apart from the increase in tramway traffic consequent on the growth of population, the individual was carried to a much greater extent than before. In 1912 the Newcastle tramways carried 50 million passengers, or 175 times the population served; in 1923 the number was 90 millions, or 271 times the population served.

From the highway authorities' point of view there were several objections to the tramcar. Owing to the non-elastic line of travel, the carriage-way had to be of greater width than when the tramcar was not used, and the cost of maintenance was increased, as much as the ordinary traffic was compelled to use the comparatively small part of the carriage-way on the flanks of the tramway line. Referring to the local light railways constructed for tramcars, Mr. Steele said that these were not only considerably cheaper to construct than tramways on roads, but cost less to maintain, while a greater speed could be run.

International Prize Competition.—We are informed that the prize "Fondation George Montefiore," worth 22,500 fr., will be awarded this year for the best original work submitted dealing with scientific progress and the technical applications of electricity in all its branches, which has been presented during the three years preceding the meeting of the judges. Particulars can be obtained from the General Secretary, Fondation George Montefiore, Rue Saint-Gilles, 31, Liége, Belgium. Attempts must be submitted before the end of April.

Appointments Vacant.—City electrical engineer (£820) for the Bath City Council. Three shift engineers for the Hongkong Electric Co., Ltd. Technical assistant and draughtsmen for wireless work for the Royal Aircraft Establishment, South Farnborough. Plumber-jointer, for the Urban District Council of Atherton Electricity Department. (See our advertisement pages to-day.)

Fatalities.—A party of men leaving work at the Fernhill Colliery, Treherbert, on February 13th, received an electric shock owing to the falling of a live cable across a handrail which they were using. Two of the men, B. Martin and W. Barwick, were killed, and two others, R. Jack and J. Jack, were injured.

Birmingham Electric Club.—This year the Club celebrates its 21st anniversary, it having been formed in the year 1904. The occasion will be specially remembered on Friday, March 6th, when the fourteenth annual dinner is held at the Grand Hotel, Colmore Row, Birmingham. Mr. F. R. Unwin, A.M.I.E.E., the president, will take the chair at 7 p.m.

Royal Air Force Apprentices.—The Air Ministry announces that in continuation of the policy of training aircraft apprentices in the skilled trades of the Royal Air Force, that two examinations for the entry in September next of 700 suitable boys will be held within the next few months. Particulars can be obtained from the Secretary, Air Ministry (M.1), Kingsway, London, W.C., before February 25th. The "Limited Competition" which is carried out by the Air Ministry in conjunction with the local education authorities will be held on June 2nd.

"All-Electric" Houses at Gateshead.—Members of Gateshead Town Council on February 14th made a private inspection of the first six of the 200 houses which the Council is building at Carr Hill under a "direct labour" scheme. The houses are each to cost £500 approximately, and will be let at rents from 11s. 3½d. to 15s. 6d. a week, according to size. The houses have been built under the Wheatley Act of 1924, and the outstanding feature is that they will be "all electric." Electrically-operated cookers, wash-boilers, radiators, &c., will be provided. The appliances are by the British Electric Transformer Company, the General Electric Co., Ltd., the Cable Accessories Company, the Metropolitan-Vickers Company, the Jackson Electric Stove Company, and the "Hotpoint" Electric Appliances Company. The electricity for the whole of the housing scheme is being supplied by the Newcastle Electric Supply Company, which is furnishing energy *gratis* to the six houses during the period of the exhibition, besides gratuitously lighting the outside surroundings.

New Photo-electric Cell.—A new electric cell that is so much affected by a beam of light that it gives enough current to operate mechanical relays without amplification was described by Mr. V. Zworykin, physicist at the Westinghouse Research Laboratory, at a meeting of the American Physical Society in Washington. The device consists of a bulb in which there are four electrodes, and which is coated with a distilled alkali metal, with the exception of a small window for the admission of light, and is filled with the rare gas argon under low pressure. One electrode acts as a filament and is heated to a low temperature, special shields preventing the light from reaching the sensitive coating.—*Science.*

Reorganisation of the Electricity Supply Industry.—An interesting article on "National Electric Power Supply," by Mr. Geo. V. Twiss, M.I.E.E., appears in *The Times Trade and Engineering Supplement*, February 14th. In comparing water power and coal, the author points out that the real merit of water power is that it compels centralised generation and decentralised utilisation and that by using coal in the same way the same results could be obtained. He advocates a comprehensive system of electricity transport to bridge over and thus co-ordinate the existing multiplicity of parochial and other separate areas of supply. He proposes the formation of a National Electricity Board to build and operate a backbone of main transmission lines throughout the country, the Board to act as a sort of clearing-house, purchasing supplies from the most efficient stations for re-sale wherever supplies are required.

The main proposals to make this scheme workable are:—

(1) The National Board to operate a national primary transmission network and for this work to be provided with initial funds (about £3,000,000) from the Government, further finance, say £4,000,000, to be provided after three years by public issue.

(2) Joint Electricity Authorities to control the secondary distribution.

(3) Retail supplies to be as at present.

(4) The Electricity Commissioners to have power to shut down any existing station which is shown to generate at a cost more than that at which a bulk supply could be obtained, £2,000,000 to be provided for redeeming capital on these stations.

(5) £8,000,000 to be provided by the Government for standardisation of frequency, &c.

(6) The Electricity Commissioners to control the industry, including the National Electricity Board and the Joint Electricity Authorities.

The author estimates the capital invested in the electrical industry at £300,000,000, and with the suggested re-organisation its proportions would be doubled in a few years. He suggests that in the absence of comprehensive supply in Great Britain, the loss is not less than £100,000,000 per annum. With the country using the most efficient machinery for generation a saving of 50,000,000 tons of coal per annum would be effected. The proposed scheme would make electricity available everywhere in the country, leading to the diffusion of industry over wider areas, thereby giving labour more congenial conditions of life. Railway electrification would be greatly facilitated, and its capital cost reduced; and what is of tremendous importance, the production of the country would be increased.

Hydro-Electric Development in Alberta.—In the article upon the above subject which appeared in our issue of January 16th (p. 102) two photographs were reproduced. These were taken by the Air Board of Canada, to which our thanks are due for permission to reproduce them.

Electricity v. Gas at Chesterfield.—As a sequel to a challenge made at a recent Council meeting there is to be a test of the rival merits for cooking of electricity and gas. Under the supervision of an independent adjudicator joints of meat are to be roasted in electric and gas cookers, and the public is to be informed which method is the more economical.

Accidental Deaths in Mines.—A preliminary return showing the number of deaths caused by accidents in and about the mines and quarries of Great Britain and the Isle of Man during the year 1924, has been prepared and is issued under the direction of the Secretary for Mines.

Particulars are shown separately for (a) Mines under the Coal Mines Act, 1911; (b) Mines under the Metalliferous Mines Regulation Act, 1872; and (c) Quarries under the Quarries Act, 1894.

In all, 1,218 separate fatal accidents, causing 1,287 deaths, are recorded. Although this is most regrettable, some consolation is found in the fact that the number of deaths is less than in the previous year by 100.

A total of 13 accidents are attributable to the use of electricity, all in mines under the Coal Mines Act, 1911; 12 being underground and 1 on the surface. Of these 4 took place in the Scottish, 5 in the Northern, 2 in the Cardiff, 1 in the Lancashire and 1 in the North Midland Divisions.

Institution Notes.

Institution of Public Lighting Engineers.—VISIT TO G.E.C. LAMP WORKS.—A most interesting visit to the G.E.C. Lamp Works at Hammersmith was enjoyed by some 50 members and friends of the Institution of Public Lighting Engineers on Friday, February 13th. Each department was visited in its turn, and with the exception of the production of the bulb, the whole manufacture of the Osram lamp was followed, from the production of the tungsten filament through its many stages of hammering and drawing, to the assembling and final sealing of the lamp.

It was particularly interesting to follow the two methods of mass production, one in which a room is itself a complete factory, the lamp being passed through the various processes on separate benches, and the other in which each bench is itself a complete factory, the lamp being passed through the various processes as it travels from one end of the bench to the other. The wireless valve works were passed through during the visit, the delicate and speedy method of assembling and welding the valve grid being the special feature of interest.

An excellent tea was provided by the G.E.C. after the tour of inspection, and Mr. E. F. Spurrell took the chair. Mr. Steward, of the Glasgow Corporation, in moving a vote of thanks to the G.E.C. management and the engineers who had conducted the party round the works, said that it had been well worth travelling a great distance to see the works; he was particularly struck by the eagerness of the company to scrap old plant and install more efficient plant. Mr. C. H. Croxford seconded the vote of thanks. Mr. C. Wilson, managing director of the G.E.C. Lamp Works, said, in reply, that the thanks were due to those gentlemen who had given up their time to see the works. Mr. Chellictti, the works manager, in proposing the toast of the Institution of Public Lighting Engineers, said that he was pleased to see members of both the electricity and gas industries together, and he thought the time had come when they might work hand in hand.

Institution of Electrical Engineers.—NORTH-EASTERN CENTRE.—*Annual Dinner.*—The members of the North-Eastern Centre held their annual dinner at Newcastle-on-Tyne on the 9th inst. Mr. W. T. MacCall, chairman, presided, and was supported by the Deputy Lord Mayor (Councillor Lowe), the sheriff (Councillor Grantham), and the president, Mr. W. B. Woodhouse. Mr. F. G. C. Baldwin, proposing the toast of "Newcastle Corporation," said that body exercised municipal control over a city which might well be proud of its association with engineering science. He mentioned the Stephensons, Sir Charles Parsons, Sir Joseph Swan, and Heaviside also was associated with Newcastle, for in the early seventies he was employed by the Great Northern Telegraph Co. in that town. The Deputy Lord Mayor and the Sheriff replied. Prof. H. Louis proposed the toast of the "Institution of Electrical Engineers," speaking of hydro-electricity. Mr. W. B. Woodhouse replied, and said that when he passed through Durham and saw the beautiful cathedral amid the haze of smoke he felt that electrical engineers had a considerable field before them. Other toasts were honoured.

INFORMAL MEETING.—At the informal meeting on February 9th Mr. A. G. Hilling was in the chair, when Capt. P. P. Eckersley opened a discussion on "Broadcasting." The attendance was far too big for the usual room, and the meeting was held in the theatre. One of Capt. Eckersley's ideals was that anybody should be able to receive anywhere with a crystal, and that anybody—again with a crystal—should have a choice of programme. At the end of 1924 80 per cent. of listeners in Britain could receive on a crystal, and 25 per cent. of receivers to-day had a choice of programme. Capt. Eckersley described some of the difficulties of transmission with equal audibility of all sounds as the standard of sound measurement. The future was with the transformer that was aperiodic, and he thought far more power must be expended in reception than was usual. Mr. C. F. Phillips, Mr. P. Voight, Mr. H. H. Dyer, and Messrs. G. F. Bedford, J. Coxon, H. E. Morrish, — Mulholland, and A. T. Smee also spoke.

Diesel Engine Users' Association.—HEAVY OIL ENGINES.—At the meeting of the Association on February 13th, Mr. P. A. Holliday read a paper on "Submarine Engines and High-speed Heavy-oil Engine Electric Generating Sets," dealing chiefly with the M.A.N. 4-stroke cycle marine engine as bearing the strongest likeness to a stationary engine. In considering the possible adaptation of ex-submarine Diesel engines for land work, it had to be borne in mind that much that appeared complicated belonged to the manœuvring gear and was unnecessary in the case of a stationary engine. The practicability of the quick-running heavy-oil engine for the purpose of electricity generating stations was of interest on account of the lower first cost and considerably smaller dimensions in comparison with the conventional type of engine for use on land. Some interesting information was given concerning the methods adopted to convert the engines to satisfactory land use, and the latter part of the paper dealt with the ex-submarine Diesel engines which had been installed in the Corporation electricity works at Southend-on-Sea, some of the M.A.N. and others of the Koerting types. An exhaust-gas boiler was fitted with each engine, steam being generated at a pressure of 160 lb. per sq. in. supplementing the main supply provided by oil- and coal-fired boilers. Waste-heat boilers were very effective silencers; they were erected close up to the engines to ensure that the quantity of heat lost was a minimum.

Electrical Research Association.—LUNCHEON.—The fourth annual report of the British Electrical and Allied Industries Research Association marks the close of another year of activity, although not distinguished by developments of a spectacular character. In connection with the annual general meeting, a luncheon was given at the Savoy Hotel on February 13th, at which, after the loyal toast and references to the late Mr. C. H. Wordingham's work for the Association, SIR FRANK HEATH, K.C.B. (Secretary, Department of Scientific and Industrial Research), proposed "The E.R.A." The electrical industry, he said, was born of, and its whole development depended on, research. In America the Western Electric, General Electric, and Westinghouse companies spent more on research than the whole of the other industries of that country. The Western Electric Co. spent 9 million dollars per year, or 1 per cent. of its sales, and had 3,000 research workers, of whom 1,500 were trained scientific men; those concerns realised that they must carry out research on a sufficiently large scale, and the nation that first grasped the fact that a comprehensive attack must be made on fundamentals, which lay at the root of things, would in a few years far outstrip others making much greater expenditure. The Government Department he represented would not be found unwilling to consider ambitious proposals.

The CHAIRMAN (Sir Philip Nash, president), in responding, pointed out that the Association's first president was an engineer and organiser, the second a pure scientist, and now it was the manufacturers' turn to give the Council the benefit of their experience. Whatever the answer to the question: Can an important discovery be hastened, or must it wait for a preordained date when it would make itself known?, let them be content with the thought that research could always accelerate the application of a discovery. Research really extended from the work of the pure scientist down to the man who had to overcome the simplest difficulty in giving effect to that scientist's inventions. Research work was as much concerned with the efficient application of human energy as it was with the application of human knowledge; and the field that was laid open within that scope was enormous. As a manufacturer, he thought the most important work that had been done was in the matter of insulating material. The work of that Association had undoubtedly improved that aspect of their business very greatly. It had enabled them to define the properties of insulating material, so that designers could design with the knowledge that the material could be depended upon. The result was that the purchaser got more reliable apparatus; the supply companies also got more reliable and cheaper material, and the consumer got cheaper electricity, and it was work of this sort that must bring them on a level with, if not place them beyond, the electrical development of countries like America and Germany. Before they could approach the Government and ask for a continuance of support, they must satisfy the Government that the industry itself was doing all it should do to support fundamentally the work of research. If they did that he thought they would obtain the further help of the Government, and he particularly appealed to electricity supply undertakings to subscribe to the funds of the Association.

Mr. Ll. B. Atkinson (chairman of Council) proposed the chairman's health, and Sir Philip replied. Mr. D. N. Dunlop toasted Mr. Atkinson, who, in his acknowledgment, emphasised the need for co-ordinating knowledge.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. N. DONKERSLEY, lately charge engineer in the Huddersfield Corporation Tramways Department supply undertaking, has been presented with a case of cutlery and books by the staff on his leaving to take up his new appointment at Brighouse.

Sir SOTHERN HOLLAND, Bart., has relinquished the position of chairman of the British Copper Manufacturers, Ltd., and he is succeeded by Mr. M. W. Henty.

Miss E. PURVIS, late of Metro-Vick Supplies, Ltd., showrooms, High Holborn, W.C., has joined the Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.

Mr. J. LINGARD, station superintendent at the electricity works, Portobello, Edinburgh, has been promoted to the position of chief assistant engineer at a salary of £750, and Mr. J. C. ROBERTSON, assistant station superintendent at Portobello, has been promoted to the position of station superintendent at £601 per annum.

Weymouth Corporation has decided to adopt a salary for the Borough Electrical Engineer (Mr. G. NICHOLSON) in accordance with the recognised scale of salaries. The salary will be £720 less £75, *i.e.*, £645, the Corporation providing a house.

At a meeting of Bath City Council, it was announced that the electrical engineer, Mr. FRANCIS TEAGUE, had tendered his resignation owing to a breakdown in his health. It was resolved to retain his services in a consultative capacity at a salary of £425 a year and to advertise for a successor at £820 per annum.

Mr. J. D. STEWART, Superintendent of Telegraphs in Dundee Post Office, who is retiring under the age limit after 46 years' service, has been presented by his colleagues with an oak Westminster chimes clock.

The Council of the Tramways and Light Railways Association recently invited Mr. A. L. C. FELL, who has relinquished his position as general manager of the L.C.C. Tramways owing to ill-health, to become one of its vice-presidents. The Council did this to mark its "sincere appreciation of his valuable services so long and so wholeheartedly placed at the disposal of the Association." Mr. Fell had been chairman of several important committees at various times and the committee in stating that he will be greatly missed, wishes him "good luck and happiness." The *Journal* of the Association pays a tribute to the late Mr. J. B. Hamilton, "whose unexpected death will cast a gloom over the entire tramway world."

East Ham Tramways Committee has deferred the question of the appointment of a permanent engineer and manager for the time being, and recommends that Mr. W. R. ELLIOTT be retained in the position for a further period of six months ending next September.

Sir E. W. PETTER, managing director of Vickers-Petters, Ltd., of Ipswich, who was recently re-elected president of the British Engineers' Association, was on January 27th presented with an illuminated address by the Ipswich employés of his company, to commemorate the conferring of a knighthood upon him by the King. A photograph of Sir Ernest was published in our issue of January 9th, p. 59. The address was signed by all the managers and representatives of every department at the works on behalf of the employés. The presentation took place at a smoking concert held at the Co-operative Hall, 500 employés being present, under the presidency of Mr. H. S. Aspinall, the general manager. The presentation was made by two employés. In the course of a very happily expressed reply, Sir Ernest referred to his recent trip across Canada and the strong desire that he found to exist there and in other parts of the Empire, to trade with the Mother Country.

On February 11th, the Grand Council of the Federation of British Industries unanimously decided to recommend the general meeting to elect Col. the Hon. VERNON WILLEY, C.M.G., C.B.E., M.V.O., who is an important figure in the wool textile trade, as president of the F.B.I. in succession to Sir Eric Geddes. Col. Willey is 40 years of age, has travelled largely, and taken an active part in various trade organisations.

CAPT. KENNETH HARBORD has been elected to the board of the Anglo-Argentine Tramways Co., Ltd., to fill the vacancy caused by the death of Mr. C. M. Rose.

Mr. S. L. PEARCE returned to Manchester this week from his visit to Australia, where he has been preparing a report on the Sydney electricity supply system.

Mr. H. G. HUGHES, who has for 23 years been associated with Siemens Bros., Dynamo Works, Ltd., and the English Electric Co., Ltd., has resigned his position with the latter company, and joined the staff of Electromotors, Ltd. He will be attached to their London office at Australia House, Strand, W.C.2.

Obituary.—MR. OLIVER HEAVISIDE, F.R.S.—The interment of the late Mr. Oliver Heaviside, F.R.S., took place on Friday, February 6th, at Paignton Cemetery, in the family grave in which his father and mother are also buried. The following were present: Mr. B. B. Heaviside, Mr. C. Heaviside, Mr. and Mrs. F. Heaviside, Miss Heaviside, Mr. and Mrs. Williams, nephews and nieces, and Mr. R. H. Tree, who represented the Council of the Institution of Electrical Engineers. The American Telephone and Telegraph Co. and the Western Electric Co. were also represented.

Electrical men will desire to associate themselves with us in expressing sympathy with Sir HARRY HAWARD, one of the Electricity Commissioners, on the sudden death of his wife. Lady Haward passed away as the result of a seizure while driving her car from Uxbridge to Beaconsfield.

MR. W. E. GUNDRY.—We regret to announce the death of Mr. Walter E. Gundry, which took place at his residence at South Woodford, on the 8th inst., at the age of 52, after a brief illness. Mr. Gundry was, in his earlier years, in the sales department of the Electrical Power Storage Co., Ltd., and just previous to the amalgamation of that company he was appointed London manager for the Premier Accumulator Co., Ltd., of Northampton, which position he held until his death. Mr. Gundry was widely respected and was actively interested in the Accumulator Manufacturers' Association. At the time of his death he was Worshipful Master of the Kelvin Lodge, of which he was a Founder when the Lodge was first formed in commemoration of the late Lord Kelvin. He was also a member of the Kelvin Royal Arch Chapter and the Kelvin Mark Lodge, of which he was Past Master. The funeral took place on Friday last, at Wanstead Cemetery.

MR. W. R. LAMPTON.—The death has occurred, at the age of 69, of Mr. W. R. Lampton, for 45 years associated with the telegraph department of the Leeds Post Office.

The Times "Deaths" column contained the following announcement last week:—"ROBINSON.—On the 10th Feb., at his residence, 72, Courtfield-gardens, South Kensington, JAMES CLIFTON, only son of the late Sir Clifton Robinson, aged 44 years."

New Companies Registered.

W. Skewes & Co., Ltd. (203,787). — Private company. Registered February 12th. Capital, £1,000 in £1 shares. To acquire the business of an electrical engineer and electrical fittings manufacturer and factor, carried on by W. F. C. Skewes at Doncaster, and to carry on the business of manufacturers and repairers of and dealers in telephones, telegraphs, phonographs, gramophones, dynamos, motors, accumulators, wireless apparatus, sets, instruments, and accessories, &c. The first directors are:—W. F. C. Skewes (permanent managing director), South Parade, Doncaster; D. W. New, 7, Victoria Crescent, Doncaster; Dorothy M. Hornby, 68, Childers Street, Doncaster; W. Hudson, Balby Road, Doncaster. Qualification £50 shares. Remuneration (except managing director) as fixed by the company. Secretary: W. F. C. Skewes. Solicitor: G. S. Ward, 1, St. Sepulchre Gate, Doncaster. Registered office: Salutation Yard, South Parade, Doncaster.

General Acoustics, Ltd. (203,774).—Private company. Registered February 12th. Capital, £5,000 in £1 shares. To acquire the business of a manufacturer of, or dealer in acoustic instruments carried on by P. V. Summer at 18, Hanover Street, W.; 14, St. Ann's Square, Manchester; 66½, Corporation Street, Birmingham; 75, Buchanan Street, Glasgow; 53, Lord Street, Liverpool; and 19, Shandwick Place, Edinburgh, as the "General Acoustic Co. (Great Britain)," and to carry on business as manufacturers of, and dealers in acoustic instruments, with or without electric or other power; to acquire and turn to account patents and the like relating to acoustics, optics, telephony, telegraphy, telautography, or other kindred science or process; to make and deal in instruments for the deaf, anatomical and other appliances, &c. The subscribers (each with one share) are:—P. V. Summer, 18, Hanover Street, W.1, manufacturer of acoustical instruments; J. G. Wright, 21, Akerman Road, Brixton, S.W.9, clerk. P. V. Summer (director of Dictograph Telephones) is permanent governing director. Remuneration of P. V. Summer as governing director or chairman, £2,000 per annum and a percentage of the profits. Solicitors: Windybank, Samuell & Lawrence, 28 and 29, St. Swithin's Lane, E.C. Registered office: 18, Hanover Street, W.

The South Midlands and Berkshire Electric Light and Power Co., Ltd. (203,734). — Registered as a "public" company on February 10th with a nominal capital of £10,000 in 9,500 cumulative participating preference shares of £1 each and 10,000 founders' shares of 1s. each. After payment out of the net profits (if any) in any one year of (a) a dividend at 8½ per cent. per annum on the preference shares, and (b) interest not exceeding 9 per cent. per annum on any notes or bonds issued, 10 per cent. of any residue is to be divided among the preference shareholders, and 90 per cent. among the founders. Upon a sale or liquidation of the assets, the founders' shares take any balance available after the holders of the preference shares, notes or bonds issued and paid up have been paid at the rate of £1 per share, note or bond. The objects are:—To establish and carry on in the South Midland counties, Berkshire, and elsewhere the supply of electric and gas light and power in all its branches, &c. The first directors are:—Sir Charles Buckworth-Herne-Soame, Sheen Cottage, Coalbrookdale, Salop; Major J. Brigden, A.M.I.C.E., 69, Ferntower Road, Highbury, N.5; R. H. Smith, Great Mawneys, Romford; A. Martin, 10, Burnside Road, Chadwell Heath, Essex. Minimum cash subscription: 100 shares. Qualification, 100 shares of either class. Remuneration (except managing director, if any), £100 each per annum (chairman £50 extra). Solicitor: P. S. Costerton, 190, Bishopsgate, E.C.2.

Castle Fuse and Engineering Co., Ltd. (203,792).—Private company. Registered February 13th. Capital, £7,000 in £1 shares. To acquire the business carried on at 72, Haigh Street, Liverpool, as the "Castle Engineering Company," to adopt an agreement with C. W. Cox, and to carry on the business of electrical, mechanical, chemical or civil engineers or contractors, factors, agents, carriers, electricians, suppliers of electricity, &c. The first directors are:—C. W. Cox, Millbrook, Spital Road, Bromborough, Cheshire, electrical engineer; C. E. C. Shawfield, The Chestnuts, Bromborough, electrical engineer (both permanent, subject to holding 100 shares each, with £360 each per annum as remuneration). Solicitors: Weightman, Pedder & Co., 1, Rumford Street, Liverpool. Registered office: 72, Haigh Street, Liverpool.

Radio Company of Great Britain, Ltd. (203,813).—Private company. Registered February 13th. Capital, £100 in £1 shares. To carry on the business of electricians, manufacturers of generators, accumulators, suppliers and distributors of electricity and electrical energy for lighting, heating, telegraphic and telephonic communications, manufacturers of and dealers in all wireless, telegraphic and telephonic apparatus, &c. The subscribers (each with one share) are:—W. R. Smith, 6, Lawley Street, Clapton, E.5, solicitor's clerk; E. J. Burrows, 29, Lyndhurst Road, Highams Park, Chingford, E.4, solicitor's clerk. The first directors are to be appointed by the subscribers. Qualification £1. Solicitors: Herbert Smith and Co., 62, London Wall, E.C.2.

Quality Radio, Ltd. (203,800). — Private company. Registered February 13th. Capital, £100 in £1 shares. To carry on the business of electrical, telegraphic, wireless telephonic and mechanical engineers, &c. The first directors are:—A. P. Partway, 24, Palace Grove, Bromley, Kent, permanent (director, Goswell Engineering Co., Ltd.); Miss D. S. Partway 24, Palace Grove, Bromley, Kent. Remuneration as fixed by the company. Solicitors: Stow, Preston and Lyttelton, 12, Lincoln's Inn Fields, W.C. Registered office: 26, Budge Row, E.C.4.

A. Tannahill & Co., Ltd. (203,675).—Private company. Registered February 7th. Capital, £3 000 in £1 shares. To carry on the business of mica merchants, manufacturers and dealers, &c. The permanent directors are:—F. W. Cumming, "Salvington," St. Peter's Road, Reading, mica merchant; W. E. Cumming, "Enfin," St. Peter's Road, Reading, mica merchant. Qualification, one share. Remuneration as fixed by the company. Secretary: W. E. Cumming. Solicitors: Pitman & Bazett, Pearl Buildings, Reading.

Official Returns of Electrical Companies.

C. F. Casella & Co., Ltd.—Particulars filed of £3,000 debentures authorised December 17th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,400.

Hindhead and District Electric Light Co., Ltd.—Issue on January 29th, 1925, of £100 debentures, part of a series already registered.

Napier-Kimber, Ltd.—S. H. Gillett, of 24, Basinghall Street, E.C.2, chartered accountant, was appointed receiver on February 4th, 1925, under powers contained in debenture dated June 5th, 1923.

Mills, English & Co., Ltd.—J. H. Bateman, of 46, Waterloo Street, Swansea, auctioneer, was appointed receiver and manager on February 4th, 1925, under powers contained in debentures dated July 31st, 1923.

Credenda Conduits Co., Ltd. (126,340).—Return dated January 14th, 1925. Capital, £50,000 in £1 shares. All shares taken up. £30,000 paid. £20,000 considered as paid. Mortgages and charges, nil.

City of Freetown (Sierra Leone) Electricity Co., Ltd. —(138,658).—Return dated December 31st, 1924. Capital, £1,000 in £5 shares. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Mawdsleys, Ltd. (91,783).—Return dated December 29th, 1924. Capital, £20,000 in £1 shares. 18,937 shares taken up. £6,937 paid. £12,000 considered as paid. Mortgages and charges, £6,300.

Orford Electric Light and Power Co., Ltd. — Issue on January 26th, 1925, of £200 debentures, part of a series.

Bower Electric, Ltd. — F. E. Kewley, of 1, Highbury Grange, Highbury, N.5, was appointed receiver and manager on February 5th, 1925, under powers contained in debenture dated November 10th, 1924.

Wholesale Electrical Company (1922), Ltd.—L. R. Stevens, of 5, Guildhall Chambers, 31-34, Basinghall Street, E.C.2, ceased to act as receiver or manager on February 3rd, 1925.

C. T. Briscoe & Son, Ltd. — Charge on 33 and 33a, Preston New Road, Blackburn, dated January 29th, 1925, to secure all moneys due or to become due from the company to the Union Bank of Manchester, Ltd.

City Notes.

The "Underground" Group.

Supplementing the brief notes which appeared in our last issue, including the dividends, we give below a summary of the 1924 reports of the railway members of the "Underground" group:—

Central London Railway Co.—The gross receipts declined by £25,039 to £547,967, while the expenditure rose by £64 to £174,976. The miscellaneous receipts were some £5,000 higher, but the net income at £260,276 was about £20,000 down. The balance available after adding the amount brought forward, and deducting interest, rentals, &c., was £267,485. The net capital expenditure during the year was £166,804; this was spent on the installation of escalators, which, it is estimated, will absorb a further £140,000 in the current year. Mention is made in this and the other reports of the reduction of fares in anticipation of the expiry of the Act of 1920 during the present month. The Bill promoted jointly by the company and the Metropolitan District Railway Co. received the Royal Assent in July last.

London Electric Railway Co.—The receipts from working at £1,861,721 were lower by £11,437, but the expenditure increased by £66,618 to £1,136,423. The miscellaneous receipts (£177,891) showed an increase of £11,035. After adding the amount brought forward and deducting £395,155 for interest, rentals, &c., there was an available balance of £619,571, as compared with £731,601 in 1923. The total capital expenditure during the year was £1,030,565 (net), of which amount the bulk was spent on extensions and rolling stock. The Camden Town Junction Railway was opened for traffic in April; by means of this line through services are worked jointly by the company and the City & South London Railway Company between Clapham Common and Edgware and Highgate. The final portion of the Edgware extension, between Edgware and Hendon, was opened in August. Work has been commenced on the extension of the Hampstead section from the Charing Cross terminus to Kennington and is proceeding satisfactorily. The construction of a new central station will shortly be commenced beneath Piccadilly Circus for facilitating the handling of traffic.

Metropolitan District Railway Company.—The receipts from working fell by £68,196 to £1,649,522, but at the same time the expenditure decreased by £75,699 to £1,141,560. The miscellaneous receipts at £196,679 were £24,752 lower. The balance available, after paying interest, rentals, &c., and adding the amount brought forward, was £425,885, a decline of £34,858. During the year £101,626 was spent on capital account, principally on rolling stock and new works and additions. The Bill of the Southern Railway Company became law and by the Act the Wimbledon and Sutton Railway is now absorbed in the Southern Railway.

City and South London Railway.—The income from working of this company increased by £11,603 to £312,426, while the expenses decreased by £1,419 to £197,032. The miscellaneous receipts were lower, but the amount paid in interest, rentals, &c., increased. Taking into account £28,783 brought forward, the available balance was £145,466, a fall of £48,517. The capital account shows a net expenditure of £2,316,184, representing the cost of reconstruction, new works, and rolling stock. The reconstructed northern section of the railway between Moorgate and Euston was re-opened for traffic in April at the same time as the Camden Town Junction Railway, referred to above, was opened. The reconstructed southern section of the railway (Moorgate-Clapham Common) was opened for traffic on December 1st.

Summary of Results.—We reproduce below a comparative statement of the results of the four companies which, with the London General Omnibus Co., Ltd., participate in the "Common Fund":—

	1924.	Increase + Decrease −
	£	£
Traffic receipts, &c., after the operation of the Common Fund	4,371,636	— 93,069
Expenditure	2,766,368	— 10,436
Net receipts	1,605,268	— 82,633
Miscellaneous receipts (net)	484,845	— 13,891
Total net Income	2,090,113	— 96,024
Interest, rentals and other fixed charges	950,843	+ 183,169
Appropriation to reserve for contingencies and renewals	155,000	— 60,000
Appropriation for equalising the charge in respect of interest on the 4½% redeemable second debenture stock	—	— 82,500
Dividends on guaranteed and preference stocks	389,477	—
Balance	594,798	— 136,693
Add Balance from last year's accounts	319,137	+ 65,944
Total amount available for dividends on ordinary stocks and shares and for other purposes	913,980	— 70,749
Dividends on ordinary stocks and shares	665,524	—
Rate per cent. per annum	3'90	—
Balance carried forward to next year's accounts	248,388	— 70,749

The traffic statistics of the four railway companies show a decline in all branches of traffic. The figures were as follows:

Passengers carried	1924.	Inc. or dec.
Ordinary	205,881,127	— 774,418
Workmen	45,479,306	— 3,045,565
Season	46,995,650	— 3,365,750
Total	298,356,083	— 7,185,733
Number of car-miles run	70,496,826	+ 1,820,986

The total capital of the four companies is £53,367,386, and in addition the capital of the Lots Road Power House Joint Committee is £3,175,000. (The L.G.O. Company's capital is £6,250,887.) The total net amount expended by the railway companies during the year on capital account was £3,814,000.

The annual meetings of the companies were held yesterday (Thursday).

Northampton Electric Light and Power Co., Ltd.

Out of the profits of 1924 £20,269 has been added to the depreciation fund, and £1,000 to the employés' benevolent fund, while £1,000 has been written off the debenture-stock discount account. In addition to the dividend on the preference shares, a final dividend of 5 per cent. (making 9 per cent. for the year as in 1923) is to be paid on the ordinary shares, leaving £4,025 to be carried forward. The amount of energy sold rose from 9,338,276 to 11,729,635 kW—an increase of 25 per cent.

Mersey Railway Co.

The accounts for the year ended December 31st, 1924, record receipts of £227,797 and an expenditure of £151,178. To the balance are added miscellaneous receipts (£10,502), a balance of £1,724 brought forward, and £1,928 available after final settlement with the Government, making £90,773. After defraying interest, rentals, &c., and allotting £6,000 towards depreciation and renewals, there is a balance of £22,203. The full dividend on the 3 per cent. perpetual preference stock is to be paid, leaving £2,731 to be carried forward. This stock received the full dividend for 1923. The meeting was to be held yesterday (Thursday).

Metropolitan Railway Co.

The report for 1924 which was to be presented at the annual meeting yesterday (Thursday), shows that the gross traffic receipts amounted to £2,264,040, as compared with £1,881,447 in 1923; the expenditure to £1,470,305, as against £1,289,996; and the net income to £793,735, as compared with £591,451. To the net income are added miscellaneous receipts amounting to £312,360 (£287,988), and a balance of £35,250 brought forward, making £1,141,345. This is distributed as follows:—Interest, rentals, &c., and appropriation to general reserve fund, £447,795; preference dividends, £267,192; ordinary dividends (5 per cent.); leaving £51,127 to be carried forward. The works necessary for dealing with the British Empire Exhibition traffic were completed before the opening of the Exhibition, and the large traffic was carried without mishap of any kind. The electrification of the railway between Harrow and Rickmansworth was completed and brought into use on January 5th last. The construction of the extension to Watford, jointly with the North-Eastern Company, has made satisfactory progress, and will, it is expected, be ready for opening during the year. Other works which are expected to be completed during the current year

are the additional junction between the Inner Circle lines and the widened lines on the west of King's Cross, and the reconstruction of the stations at St. John's Wood, Willesden Green and Aylesbury. The reconstruction of Aldgate and Edgware Road stations will be taken in hand during the year.

Dublin United Tramways Co. (1896), Ltd. Presiding at the annual meeting of this company on February 9th, Mr. Joseph Mooney said that the bad weather of last summer had an adverse effect on the receipts, which were £679,092, as against £702,122. The company's Bill for power to run omnibuses in the outlying districts had now practically passed into law. They had been approached by the Lucan Electric Railway Co. to purchase this company's line and link it up with their system, but they found that conditions would not allow them to do anything in the matter. An expenditure of £70,000 would be required to bring the line up to their standard. The generating machinery at the company's power station was being renewed, involving a contemplated outlay of about £60,000. They were restrained from supplying current outside their own requirements, but he thought they should have authority for such enterprise. The Dublin townships and the Great Northern Railway (Ireland) had asked them to supply current, but they were, of course, unable to do so.

Westminster Electric Supply Corporation, Ltd. The balance of the net revenue account for 1924, after providing for general reserve and depreciation fund and other charges, was £168,918. The interim dividends absorbed £50,156, leaving a balance of £118,762, which it is proposed to distribute as follows:—Balance of preference dividend, £12,375; final dividend on the ordinary shares of 7s. per share, making 12 per cent. for the year, £52,893; and a bonus of 3s. per share, £22,669; leaving £30,825 to be carried forward.

After the annual meeting, which is to be held on Wednesday next (February 25th), resolutions will be put forward empowering the directors to take such steps as are necessary to protect the shareholders' interests in connection with the London Electricity Supply (No. 2) Bill and the London and Home Counties Electricity District Scheme; sanctioning the issue of the remaining 90,000 4½ per cent. cumulative preference shares, as to 40,000 as ordinary shares, the balance being issued as cumulative preference shares as considered desirable; approving the division of the £5 shares into five shares of £1 each; and sanctioning the capitalisation of undivided profits for issue to existing shareholders "at any time and from time to time."

If the last three resolutions are passed, they will be submitted for confirmation at a meeting to be held on March 25th.

Yorkshire Electric Power Co., Ltd. Mr. A. G. Lupton (chairman) presided at the annual meeting, on February 10th, and in presenting the report and accounts for 1924 (*vide* ELEC. REV., February 6th (p. 226), said that last year a House of Lords Committee had decided not to allow the company's Bill to proceed. The directors had been advised that such a Bill was necessary to secure the company's position in view of the pending reorganisation of electricity supply in the area. The company was at present negotiating with the principal distributors in an endeavour to carry out a scheme by means of agreements supplemented by an Order from the Electricity Commissioners. The Board could only proceed with this matter if the company's position was made secure. Mr. Lupton expressed his regret that politicians should be able to hold up beneficial schemes of this nature.

A great part of the advance made by the company during the year was due to the growth of the domestic load which the directors were determined to encourage. A large number of the new housing schemes in the company's area had definitely adopted electricity for lighting. As mentioned in the report, important extensions of plant and mains were in progress or prospect and further capital was needed. It was proposed to make an immediate issue of ordinary shares at the price of 23s. 6d. each; the letter of offer would be in the shareholders' hands in a few days.

Mr. Lupton said that a great deal of discussion had recently taken place with regard to electricity in agriculture. Enthusiasts gave very little thought to the cost of this service and to the very poor return. In countries where the system had been tried it was found that the small amount of power required by the farmers stood in the way of general extension. As the company's system was developed for other purposes it became possible to supply farmers, but to establish a system solely for the farmers would not be commercially justifiable.

The report and accounts were adopted, and approval was given to the immediate issue of £100,000 in ordinary shares to be followed as and when required by a further £773,000 in ordinary or preference stock as might be decided.

Chloride Electrical Storage Co., Ltd. An extraordinary meeting is being held to consider resolutions for increasing the capital to £500,000 by the issue of 200,000 new shares of £1 each. Of these 91,625, together with 18,250 shares remaining unissued, will be allotted to the present shareholders, the remainder being issued as and when required. It is proposed to capitalise undivided profits to the extent of £109,875 to cover the first issue to shareholders.

Fife Tramway, Light and Power Co. At the annual meeting, on February 12th, Mr. William Low, LL.D., O.B.E., stated that the business of the company continued to show expansion, although the trade and operating conditions prevailing during the year affected adversely the trading profits to some extent. The gross receipts of all of the properties owned by the company totalled £348,284 for the year, as compared with £315,916 for the previous year. In dealing with the balance-sheet, he drew attention to the fact that the issued share capital had been increased to £1,000,000, and that the whole of the authorised share capital had been issued. The directors considered the financial conditions during the year propitious for the redemption of the 7 per cent. debenture stock.

St. James' and Pall Mall Electric Light Co., Ltd. The report for the past year, which is to be presented at the annual meeting on March 3rd, records a net profit of £44,078, to which is added £16,315 brought forward, making £60,393. The interim dividends required £13,500, and it is proposed to pay the remainder of the dividend on the preference shares, to pay a final dividend of 7s. 6d. and a bonus of 5s. per share on the ordinary shares (making 17½ per cent. for the year), and to carry forward a balance of £18,398. During the year the connections were increased from 22,721 to 24,073 kW, and a total of 21,143,734 kWh was supplied to consumers. Mention is made of the Bill promoted by the London Electricity Joint Committee (1920), Ltd., which has passed its first reading.

Allmanna Svenska Elektriska A.B. After having written off 1,252,000 kronen for depreciation in 1924 as compared with 1,497,000 kr. in the previous year and set aside 550,000 kr. for taxes (250,000 kr. in 1923), this company shows net profits of 2,031,000 kr. as against 558,000 kr. in 1923. Including the balance forward the amount available for disposal is 2,117,000 kr., permitting of the payment of a dividend at the rate of 2½ per cent. and the carrying forward of 242,000 kr. Out of the net profits in 1923, 472,000 kr. was applied to extinguishing the loss brought forward and the remainder was transferred to 1924.

French Companies. The *Compagnie Hydro-Electrique d'Auvergne*, of Paris, has recently invited subscriptions for 40,000 new ordinary shares of 500 fr. at 540 fr. each.

Electricité et Gaz du Nord.—The accounts for 1923-4 show net profits, after allotting 4 million fr. to sinking funds, of 12,402,293 fr., from which was distributed to the fully paid shares 8,436,002 fr. gross, 16.50 fr. gross to the quarter-paid shares, and 240 fr. gross to the *parts beneficiares*. The sale of h.p. current showed an increase of 22,000,000 kWh and the company further developed its plans for rural electrification. Numerous additions to the equipment of its several stations were made during the year, while its seven subsidiary companies also satisfactorily progressed.

The *Société Electrique du Nord-Ouest* has decided to raise its capital from 28,000,000 to 56,000,000 fr. by the issue of 56,000 500-fr. shares.

An extraordinary meeting of the *Forces Motrices de la Vallée d'Aspe* has sanctioned the raising of the company's capital from 17,000,000 to 30,000,000 fr. by the issue of 52,000 250-fr. shares. The capital is needed for the completion of the harnessing of several falls, notably those on the Baralet and the Bedous rivers and other works of extension. Five companies are now customers for the company's available supplies of energy.

German Loans in the United States.—The *Sachsische Elektricitätswerke Gesellschaft*, of Dresden, has negotiated a loan of 15 million dollars from a New York financing house. The rate of interest is 7 per cent. and the loan is to run for 20 years, the electricity company having the right to pay it off at the end of five years. The money is required in connection with the establishment of a large new generating station at Bohlen, near Leipzig.

It is reported from New York that the loans floated by the A.E.G., Siemens-Schuckertwerke, and Siemens & Halske were immediately over-subscribed.

Montreal Light, Heat, and Power Consolidated.—The gross revenue for 1924 was $17,394,092, an increase of $1,253,131. The operating expenses and taxation amounted to $7,984,493 ($7,113,961), and depreciation $1,739,409, leaving $6,460,412 available. The dividend absorbs $4,524,904, $150,000 is placed to an insurance reserve, $20,000 is contributed to the pension fund, and a balance of $1,765,508 is carried forward.

Tottenham District Light, Heat and Power Co., Ltd.—The report for 1924 shows that while the profit from the gas undertaking fell by £11,404, that from the electricity branch rose by £1,794. In addition to the payment of the dividends reported in our last issue, £1,000 is placed to the electricity renewals fund and £34,295 is carried forward. Nothing is allotted to the insurance and reserve funds.

South London Electric Supply Corporation, Ltd.—Final dividend of 10 per cent., less tax, on the ordinary shares, making 15 per cent. for the year (1923 dividend, 12 per cent. and a bonus of 3 per cent.).

County of London Electric Supply Co., Ltd.—Final dividend of 10 per cent., less tax, on the ordinary shares, making 15 per cent. for the year (1923 dividend, 12 per cent. and a bonus of 3 per cent.).

Rushden and District Electric Supply Co., Ltd.—Although the company continued to progress during 1924, the revenue was temporarily checked by the further reductions in prices. Out of the year's profits £2,093 has been added to the depreciation fund, and £1,000 placed to a reserve fund. A final dividend of 4½ per cent. (making 8 per cent. for the year, as in 1923) is being paid, leaving £1,506 to be carried forward.

Bell Telephone Co. of Canada.—The *Financial Times* says that it is informed that British investors will be offered bonds to the extent of $5,000,000 of the total issue of $25,000,000 of first mortgage bonds which is being made. The new issue is for the purpose of refunding the existing bonds ($16,750,000) and to provide new capital to cover expenditure during the current year.

Companies Struck off the Register.—The names of the undermentioned companies have been struck off the Register and are thereby dissolved :—

Leeds Battery Co., Ltd.
Regent Electrical Installation Co., Ltd.
Select-O-Phone, Ltd.
Thermophone Co., Ltd.

Spanish Company.—The *Compañia Sevillana de Electricidad* has acquired the Huelva generating station with its mineral zone and distribution network. To meet the new obligations involved the company has decided to raise its capital from 40,000,000 to 50,000,000 pesetas by the issue of 20,000 500-peseta shares at a premium of 25 pesetas per share.

Tyneside Tramways and Tramroads Co.—The report for the past year shows that the net revenue was £2,758. To this is added £975 brought forward, making £3,733. Interest on mortgages, loan, &c., absorbs £1,880, and the preference dividend £601. £500 is transferred to the renewals, &c., reserve and £751 carried forward.

Central Electric Supply Co., Ltd.—The net profit for 1924 was £4,993 (against £5,010 in the previous year). To this is added £15 brought forward; a dividend of 5 per cent. is proposed, leaving £8 to be carried forward. The total amount of energy supplied to the companies interested in the Central Company was about 66 million kWh.

Tokio Electric Light Co.—It is reported that a further issue of £600,000 six per cent. sterling bonds is being placed on the market privately, these bonds being part of the authorised issue of £6,000,000. The proceeds are for the repayment of short-term loans contracted in this country.

Charing Cross Electricity Supply Co., Ltd.—The directors recommend a final dividend of 1s. 9d. per share on the ordinary shares of the West End Undertakings, making 3s. for the year (15 per cent.). The 1923 dividend was 14½ per cent., and a capitalised bonus of 20 per cent. was also distributed.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be officially quoted :—

Montreal Tramways.—$3,266,000 first and refunding mortgage five per cent. 30-year gold bonds. Nos. M17,283 to M19,930 and M19,937 to M20,389 of $1,000 each, and D1,607 to D1,936 of $500 each.

Mather & Platt, Ltd.—The directors propose to pay a final dividend of 5 per cent. (making 10 per cent. for the year) and a bonus of 5 per cent., both free of tax, as in 1923. The carry-forward is increased from £178,398 to £182,855.

Telegraph Construction and Maintenance Co., Ltd.—A final dividend of 7½ per cent., free of tax (making 10 per cent. for the year), has been declared.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—A dividend of $0.50 per share is being paid in respect of the quarter ending March 31st.

New Issues.—*Newcastle-upon-Tyne Electric Supply Co.*—The issue of 465,000 new ordinary shares to the shareholders of the company has been over-subscribed.

Marconi Wireless Telegraph Co., Ltd.—The company announces an issue of 500,000 ordinary £1 shares at 27s. 6d. per share, in proportion of one new share for every six held.

Crossley Bros., Ltd.—Out of the net profit of £47,312 in respect of the past year, the directors recommend the payment of the 7 per cent. preference dividend, leaving £19,075 to be carried forward.

International Light and Power Co.—A dividend of 6 per cent. (less British tax) has been declared on the preference shares, bringing the payment of arrears up to December 31st, 1924.

Stocks and Shares.

MONDAY EVENING.

THE declaration of the electricity supply dividends is now going on at a steady rate, and it must be said that the enthusiasts are a little disappointed at the results so far announced by the companies. The Charing Cross Electric Supply Co. has advanced its rate to 1s. 9d. per share, making 15 per cent. for 1924, as against 14½ per cent. last year. In the previous period, it will be remembered, the company issued a capitalised bonus of 20 per cent., which had the effect of increasing the ordinary share capital by £96,000. The larger dividend is now paid on the whole of the capital, and the announcement has given satisfaction. The Westminster and the London companies, as already mentioned, maintain their previous rates of 15 per cent. and 10 per cent., respectively. The St. James's and Pall Mall Company repeats its 1923 dividend of 17½ per cent., the figures differing comparatively slightly from those of 12 months ago, although the current which is being sold shows an enormous increase. Prices of the shares in the market are marking time. County of London and City Lights are attracting more interest than the others in the group, and there is a good deal of curiosity felt as to whether either of these two companies will increase its dividend of 15 per cent. This latter rate is now being paid by the Charing Cross, South London and Westminster Companies.

The Westminster Electric's report announces that at the forthcoming meeting shareholders will be asked to sanction an increase in the company's capital by the offer of the unissued preference shares, part of which are to be treated, apparently, as ordinary. When this is done the directors propose to give five shares of £1 each for each share of £5, and this will bring the Westminster into line with the others of the same group that have adopted a practice whose advisability has been so frequently urged here. The Kensington and the St. James' and Pall Mall will be the only companies left in the London electricity supply division to cling to a higher denomination of ordinary shares than that of the popular £1. It may be guessed that none of the companies which have split their shares regret having done so. But it took a long time to persuade the boards that their shareholders' interests stood to benefit by a system which many directors feared would encourage mere gambling in the shares of their companies. This apprehension experience has proved to be groundless so far as the London electricity supply industry is concerned.

Stock is not difficult to place, notwithstanding the quietude of business in the Stock Exchange. An amount of £600,000 Tokio Electric sixes was taken in one line a few days ago. This went largely into permanent hands, but a portion is on offer at about 89, the same quotation as obtains for the previously existing bonds. In another case £200,000 stock of a well-known electricity supply company, operating in the country, was placed in the course of an afternoon by a few Stock Exchange firms. There is at the present time a fair quantity of Edmundson's ordinary to be obtained in the neighbourhood of a guinea. On the basis of the 7 per cent. dividend the yield will work out at 6¾ per cent. on the money.

The South Midlands & Berkshire Electric Light & Power Co., Ltd., has been recently registered as a public company, with a nominal capital of £10,000. This is divided into 9,500 cumulative participating preference shares of £1 each and 10,000 founders' shares of 1s. each. The first director named is Sir Charles Buckworth-Herne-Soame, of Coalbrookdale, Salop. This gentleman appears as chairman of the Electric Light & Power Contracts Finance Corporation, Ltd., to which, as will be remembered, we have already made reference in this column.

Formation of an association between some of the principal British cable companies has led to a renewal of investment attention being directed to the stocks and shares of the Eastern group. The prices of the quartette are all higher on the week, and the market, as a whole, is a good one. Anglo-American preferred has strengthened. Great Northerns are 10s. higher. Cuba Submarines gained 5s. The telephone shares are also hard. Orientals show a gain of ½ at £2. Marconis went up to 36s. in consequence of a sharp rally in Canadian Marconis to 5s. 4½d. Its successful raising of new capital by the Canadian Marconi is deemed an augury for more profitable working than that concern has hitherto enjoyed. The parent shares reacted to 35s., but Canadians held their recovery. Automatic Telephones parted with a little of their previous breathless rise, and are now quoted at 32s. 6d. Manufacturing shares remain steady, Telegraph Constructions advancing to 27½. The dividend keeps at 20 per cent., tax free, and the yield on the money is no more than 4½ per cent., allowing for accrued interest, from which it would seem apparent that the persistent buyers look for something in the nature of a bonus.

Home Railway issues are dull and lifeless. Underground Income bonds improved to 102, but the £10 shares fell back to 2½. Another fall of a point, to 52½, in Districts, is reflection of the disappointment felt with the latest figures published by the company and its brethren. Metropolitan, after a dip to 80, rose to its last week's price of 81. No changes have occurred in London & Suburban Traction preference or London United Tramways debenture; the former changed hands the other day at 5s. 6¾d. In the foreign traction department, Anglo-Argentine second preference hardened to 3½. Brazilian Tractions have gone back to 57.

Engineering, iron, coal and steel shares continue under the shadows of fears that there may be a coal strike. The rubber share market displays no vitality, despite a small rise in the price of the produce. Business in most Stock Exchange markets is of moderate—not to say retail—proportions.

Share List of Electrical Companies.

	Nom.	Dividend. 1922.	Dividend. 1923.	Price Feb. 16. 1924.	Rise or fall.	Yield. p.c.
Home Electricity Companies.	£					
Bournemouth and Poole ...	1	10	13	2½	—	4 12 8
Brompton Ordinary	1	12	10	1⅝	—	*5 6 8
Charing Cross Ordinary	1	14	14½	46/3	—	6 9 7
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	10	12	37/6	—	6 8 0
City of London	1	15	15	49/6	—	6 1 0
do. do. 6% Pref. ...	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	10	15	53/3	—	5 14 1
do. do. 6% Pref. ...	1	6	6	23/6	—	5 2 2
Edmundson's Ordinary	1	7	7	21/-	—1/-	6 13 4
do. 7% Pref.	1	6	6	22/6	—	6 4 5
Elec. Supply Corporation ...	1	8	10	27/-	—	7 8 2
Kensington Ordinary	5	12	14	19½	—	6 4 5
Lancs. Light and Power ...	1	Nil	7½	27/-	—	5 11 1
London Electric	1	10	10	35/-	—	5 14 3
do. do. 6% Pref. ...	5	6	6	5½	—	5 9 1
Metropolitan	1	8½	10	1⅞	—	5 6 8
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5	5½	24/3	—	4 10 7
Newcastle-on-Tyne Ordinary ...	1	2½	6	1⅛	—	5 6 8
do. 5% Pref. ...	1	5	5	18/9	—	5 6 8
do. 7% Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	9½	—	6 4
North Met. Elec. 6% Pref. ...	1	6	6	1¼	—	5 6 8
St. James' and Pall Mall ...	5	14½	17½	13½	—	6 12 3
South London	1	11	15	2⅞	—	6 3 0
South Metropolitan Pref. ...		7	7	1¼	—	5 12 0
Urban Ordinary	1	—	4	12/9	—	4 5 4
do. 6% Pref. ...	1	5	6	19/6	—	6 3 1
Westminster Ordinary	5	12	15	11⅛	— ⅛	6 14 10
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8	8	31/-	—	5 3 4
Home Rails.						
Central London Ord. Assented Stock	4	4		74	—	5 8 1
Metropolitan ... ... ,,	3½	4		81	—	6 3 7
do. District ... ... ,,		3½		52½	—1	6 13 4
Underground Electric Ordinary	10	Nil	Nil	2¾	— ⅛	Nil
do. do. "A" ...	1	Nil	Nil	8/6	—	Nil
do. do. Income	Bonds		6	102	+1	*5 17 10
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	104	—	5 15 5
do. Def. ... ... ,,		1½	1½	23½	+ ½	6 6 4
Automatic Telephone	1	Nil	3	1⅝	—	1 17 0
Chili Telephone	5	6	6	5½	—	*5 4 4
Cuba Sub. Ord.	10	7	7	7½	+ ½	9 13 2
Eastern Extension	10	10	10	17½	+ ½	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	+2	*5 14 0
Globe Tel. and T. Ord.	10	10	10	17½	+ ½	*5 12 8
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	24	22	30½	+ ½	7 4 3
Indo-European	25	7	7	32½	—	*5 6 1
Marconi	1	15	10	1¾xd	—	5 14 8
Marconi Marine	1	10	10	1⅜	—	8 17 10
Oriental Telephone Ord. ...	1	12	12	2	+ ¼	*6 0 0
United R. Plate Tel.	5	8	8	6½	+ ⅛	*6 0 9
Western Telegraph		10	10	17½	+ ½	*5 16 0
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref. ...	5	12½	5½	8¾	—	8 9 2
do. do. 2nd Pref. ...	5	5½	6	24	+ ½	9 12 0
do. do. 5% Deb. ...	Stock	5	5	70½	—	6 10 9
British Electric Traction Ord. ...	,,	5	6	101½	—	5 18 3
do. do. 6% Pref. ...	,,	6	6	106½	—	5 14 9
Brazil Traction	100	4	4	57xd	—1	7 0 4
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	91½	+2	5 9 3
do. do. Preferred	,,	5	9/6	91½	—	*5 5 0
do. do. Deferred	,,	8	129/5	113½	—	*5 14 8
do. do. Deb.	,,	4½	4½	81½	—	5 4 4
Lond. & Sub. Trac. 5% Pref. ...	1	5	2½	6/-	—	Nil
London United Tram. Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds ...	—	Nil	5	72	—	6 19 0
Mexican Light Common ...	100	Nil	Nil	25	+ 1	Nil
do. Pref.	100	Nil	Nil	60½	+ ½	Nil
do. 1st Bonds	—	5	5	67	—	7 9 3
Yorkshire (West Riding) ...	1	—	5	1¼	—⅛	4 14 0
Manufacturing Companies.						
Babcock & Wilcox	1	20	12	55/-	—	*4 7 8
British Aluminium Ord.	1	5	5	92/-	—	3 2 6
British Elec. Transformer Pref.	1	Nil	Nil	17/6	—	... ...
British Insulated Ord.	1	15	15	3	—	5 0 0
Brush Ord.	1	10	10	24/6	—	3 3 4
Callenders	1	15	15	3⅛	—	4 17 10
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	5	Nil	⅛	—	... ...
Edison-Swan	4/-	7½	10	6/6	—	6 3 0
do. 5% Deb.	Stock	5	5	81½	—	6 0 3
Electric Construction	1	10	10	32/6	—	6 3 1
Enfield Cable, Pref.	1	7½	7½	1¼	—	6 0 0
English Electric	1	8	5	20/3	—	4 18 9
do. do. Pref.	1	6	6	21/6	—	5 11 7
Gen. Elec. Pref.	1	6½	6½	23/3	—	5 11 10
do. Ord.	1	5	5	22/3	—	4 10 0
Henley	1	15	15	3	—	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	10	5	17/6	—	*5 14 8
Johnson & Phillips	1	5	5	1⅛	—	3 18 2
Met-Vickers, Ord.	1	12½	8	1¼	—	6 8 0
do. Pref.	2	8	8	2½	—	6 8 0
Siemens Ord.	1	5	—	1⅛	—	4 4 0
Telegraph Construction ...	12	20	20	27½	+ ½	*4 8 0

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances

CHEMICALS, &c.	Price Feb. 17.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	6¾d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal)	£62	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£35	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£150 to £125	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£242	£1 inc.
Grade II ... ... ,, ,,	£174	...
Grade III ... ... ,, ,,	£101	...
c Brass (rolled metal 3' to 12' basis) per lb.	10½d.	...
c ,, Tubes (solid drawn) ... ,,	1/0½ to 1/0½	...
c ,, Wire, basis ... ... ,,	10½d.	...
c Copper Tubes (solid drawn) ... ,,	1/1½	...
c ,, Bars (best selected) ... per ton	£96	£1 inc.
c ,, Sheet ... ... ,,	£96	£1 inc.
c ,, Rod ... ... ,,	£96	£1 inc.
d ,, (Electrolytic) Bars ... ,,	£71 5s.	20/- inc.
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ... ,,	£80 5s.	2/- inc.
d ,, ,, H.C. Wire per lb.	10½d.	½d. inc.
f Ebonite Rod ... ... ,,	2/- to 3/6	...
f ,, Sheet ... ... ,,	2/- to 3/6	...
a German Silver Wire ... ... ,,	2/8	...
b Gutta-percha, fine ... ... ,,	8/6	...
b India-rubber, Para fine ... ... ,,	1/5	½d. dec.
f Iron Pig (Cleveland Warrants) ... per ton.	£5 2s. to £5 3s. 6d.	...
f ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English Pig ... ... ,,	£38 10s.	5/- inc.
g Mercury ... ... per bot.	£12 5s.—£13	15/- dec.
e Mica (in original cases) small ... per lb.	8d. to 9/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/9½	...
p ,, ,, drawn bars & rods ,,	1/8	...
p ,, ,, rolled strip & sheet ,,	1/9½	...
p ,, ,, wire ... ... ,,	1/4	...
e Platinum ... ... per oz.	£26	...
d Silicium Bronze Wire ... ... per lb.	1/0½	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
e Tin, Block (English) ... ... per ton.	£263 10s. to £264	£2 10s. inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/2	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Mathey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Industrial Standardisation.—In an address given in Prague and Brno in December, 1924, at the invitation of the Czecho-Slovakian Engineering Standards Committee, Mr. C. le Maistre, C.B.E., secretary of the British Engineering Standards Association, said he was convinced that great economies could be effected in the use of materials and apparatus of all kinds through judicious simplification and standardisation carried out on a national basis. British standard specifications were arrived at by unifying the needs of industry and recommending what was best in present practice and what could be adopted by industry with the least possible disturbance. Whilst the attempt to standardise whole machines was to be deprecated, the standardisation of component parts with a view of obtaining interchangeability was of immense value. It was their experience that to be of lasting benefit the proposals for standardisation or simplification should emanate from industry itself. National standardisation was really a science all of its own, and it was only gradually that the underlying principles had evolved themselves and its great economic value become recognised. A committee nominated to standardise steel sections had reduced the number of sections from many hundreds to 113, resulting in a saving estimated at about a million pounds a year in the cost of production to the steel industry. Another remarkable saving to the country had been the reduction of tramway rail sections from 75 to 5. Industrial standardisation had made immense strides since the war, and there were now under the control of the B.E.S.A. over 400 committees and over 2,000 members giving their time and service to this national work free. The B.E.S.A. did not exercise coercion in any way, and it had no other authority than that of engineering public opinion. It was not a profit-making concern; it had nothing to get but all to give for the benefit of British industry.

Peru as a Market for Electrical Supplies.

Demand for the more Expensive Types of Machinery.

(From our Special Correspondent.)

An interesting struggle is at present proceeding in Peru between German and Italian firms for the privilege of equipping the South American Republic with electrical machinery and appliances. It would appear that victory is likely to go to the Italians, since they hold a firm grip upon the foreign supply market by reason of their considerable local electrical interests. The improvement in the economic conditions of Peru, and the facility with which both the Government and the municipalities are enabled to raise capital for improvements, offer distinct encouragement to foreign manufacturers of electrical plant, and of this the Italians are taking the fullest advantage, in some cases financing undertakings, and in others giving long-credit facilities.

To some extent, however, they are handicapped by reason of the exchange position, which does not now affect Germany to the same degree, if at all. Before the war, Germany held a very strong position in Peru, the value of which was only exceeded by the trade done by the United States and the United Kingdom. Thus, in 1913, Germany's exports reached £P1,026,500, whereas imports from the United Kingdom were £1,554,000, and those from the United States £1,706,000. Of these totals electrical supplies formed a considerable proportion, Germany furnishing the larger part of the heating and lighting devices, incandescent lamps, general accessories and flexible cord.

Wiring materials and devices exported by Germany to South America are, to a considerable extent, a development of that country's own standards and practices. Wiring materials and devices are tested in the Fatherland by the Association of German Electricians. The general wiring practice which they have introduced into the South American countries is to use Bergmann tubing concealed in the walls. Where it is impossible to adopt this procedure, the tubing is covered on the surface. Wiring is also frequently installed in rubber tubes concealed in the walls; but the insurance companies operating in South America, like those in Germany itself, demand that the electric wires be drawn into such tubes after the walls are completed, thus assuring that the conductor can always be replaced if necessary. It is not allowed to wire buildings with bare flexible wires. The standard copper wire-gauge used is metric. It is customary to wire fixtures and other devices with 0.75 sq. mm., while 1.0 sq. mm. is the required minimum permissible for general wiring.

In many of the South American States, especially Argentina, Brazil, Chile and Peru, the German type of switches, sockets and other fixtures is more frequently met with. Rotary snap switches are used, but the tumbler and push types are employed to some extent in some of the larger buildings, such, for instance, as the new hotels recently erected in Lima, Peru. Edison-screw sockets are used in these and other buildings, the British bayonet type having largely gone out of use, and being employed only by railways and street car companies.

Before the war, Italy had hardly made any mark, and it is only since the Armistice that Italian influences have been so strongly felt. At the present time the output of electrical apparatus of all kinds is considerably in excess of the previous years' operations, and, although the domestic demand is still heavy, that of foreign countries, including the South American Republics and particularly Peru, have recently offered much wider scope. The position of Italy, however, is peculiar in that the manufacturers cannot afford to dispense with a number of special types made in insufficiently large quantities in the country and not, therefore, available for export abroad. Large quantities of telephone and telegraph material, however, are now manufactured in Italy expressly for shipment, and during the past few weeks an enormous quantity of cable and wire has been sent to Peru to be employed in connection with contracts taken up by the Italian interests already referred to.

In almost every town throughout the Republic there is to be found an electricity supply, and a certain amount of street and park lighting. This is usually carried out by means of incandescent 40-W lamps, operating on standard multiple circuits. While in Arequipa the street lighting is carried out upon this principle, the Plaza, or central square, is provided with high-power gasfilled lamps with hood reflectors. The lighting in Lima and Callao, however, is on a slightly different principle, consisting of incandescent and arc lamps and a small number of gas-burners. On the occasion of public holidays and feast-days, the whole square (where the Government buildings are located) is lighted with thousands of incandescent lamps, the greater part of which are 60-W lamps. It may be said that the lighting of Lima is now carried out by electricity, and gas-lighting is a thing of the past. This change has been the more readily brought about by reason of the fact that the gas-lighting company and the electric-lighting company are the same; thus there was no opposition to overcome. Over 700 arc and high-power incandescent lamps help to brighten the city of Lima at night-time, the arc and incandescent lamps operating in series on the same circuits. Almost equally good lighting services are enjoyed by the suburbs of Miraflores, Barranci and Chorillos. The port of Callao is admirably lighted, and the loading and unloading of ships goes on with facility during hours of darkness.

Peru is at present offering a good market for electrical apparatus of a more expensive character, such as d.c. generators, a.c. generators under 2,000 kVA, accessories and parts. In this respect Peru is rather an exception to the other South American countries, for, on the whole, the markets there have shown a decrease, during the past year, in purchases of equipment. In view of the many important contracts which have been entrusted to private enterprise, including new dock and harbour construction and several new railway lines, Peru is likely to maintain the demand for electrical goods in general. Broadcasting apparatus and material are likely to find a much better market in future in view of the fact that a 10-year exclusive concession has just been granted to the Peruvian Broadcasting Co.

Human Management.—In the course of an article which he contributes to the January issue of *Industrial Welfare*, Mr. Oliver Sheldon (Rowntree & Co., Ltd.) says:—"In industry, the fact that a man has gained a great knowledge of management will not necessarily mean that he is a good manager. He must have skill in the application of his knowledge, and in management this skill must form a larger proportion of his qualifications than his knowledge, for industrial management is primarily the management of human beings. Knowledge, without skill, will carry a man far in some professions, but in executive management it will only take him to a door which, to him, must remain closed. The manager is confronted with a hundred human problems; his knowledge of costing, of mechanics, or of planning, will not alone solve them, and for human problems there is indeed no science. The successful manager of the future will be he who, having attained a profound knowledge of the science of management, can use that knowledge in what is, after all, pre-eminently a human task—the art of managing men and women."

Electricity Supply Engineers and their Training.

By J. W. THOMAS, B.Sc., A.M.I.E.E.

TURNING over the pages of the *Journal* of the I.E.E., issued in December, one could not help being struck, in reading the chairmen's addresses, by the frequent references to the subject of the training of engineers.

In his inaugural address the President, Mr. W. B. Woodhouse, called attention to the rapid growth of the electricity supply industry, and the increasing importance of the problem of providing suitable training for the younger men upon whom the conduct of the industry will devolve in the future.

Mr. Coote Cummins, in addressing the Irish Section, went further still and eloquently pleaded not only for the better training of engineers, but for the protection of properly trained practitioners from those persons who pose as engineers without possessing the necessary qualifications. Mr. B. Johnson, in his address to the North Midland Centre, also touched on the allied topic of the vocation of the engineer.

All these references are significant, and may be taken as a sure sign that this important subject is at last beginning to receive the careful consideration which it deserves. The address of Mr. Coote Cummins was probably one of the most outspoken utterances that has ever been made before the I.E.E., and is deserving of close attention, inasmuch as it dealt frankly with an aspect of the problem which engineers in the past have been reluctant to appreciate, *viz.*, the necessity for securing complete recognition of the engineering profession, similar to that enjoyed by the medical and legal professions, and protection from the unqualified and the incompetent practitioner. As he rightly pointed out, no system of training can give satisfactory results without the protection afforded by "limited practitioners."

To quote his own words:—

> "The best training that could be devised for doctors and lawyers would be almost completely neutralised if utterly unqualified persons were permitted to practise, and under such conditions both of these professions would fall back to somewhat the same status which existed when the local barber was the recognised medical authority in his district."

The present writer has previously advanced in these columns (January 4th, 1924) a similar argument, and he is glad to have it supported from such a quarter.

Whether the engineering profession will ever reach the goal attained by the older professions of medicine and law remains to be seen, but even those who question the practicability of its ultimate attainment will not deny that there is still a great deal to be done in the way of improving both the status and general standard of competency of engineers engaged in electricity supply.

The first step in this direction must be the recognition by electricity authorities that they have a responsibility in the matter, and that only in so far as they themselves take a direct interest in the formulation and supervision of a suitable scheme of training can they expect to be supplied with competent men in the future.

In this connection, Mr. Woodhouse gave a clear lead when he advocated that electricity supply authorities should shoulder the responsibility of bearing the cost of post graduate courses and the arranging of interchanges with manufacturing works.

Reference has previously been made in these columns to the Report on the Training of Engineers formulated by the Electrical Power Engineers' Association in 1922, and submitted to the employers on the National Joint Board. The latter decided first to refer it to the various District Joint Boards for their comments. As the report has been the subject of very careful consideration, and has been favourably reported upon both by the majority of the District Joint Boards and the National Joint Board, it will not be out of place to summarise its main recommendations.

The first portion deals with the advantages of having a definite system of training, in place of the present haphazard arrangement for recruiting engineers into the industry. Not only is an agreed scheme likely to benefit the engineering profession, but it is calculated to be of decided advantage to the employers by providing them with a reservoir of competent men on which they can draw to fill vacancies, and also to the industry consequent upon the increased efficiency which is bound to accrue as a result of the improved capacity of the technical staff.

The scheme outlined is intended to be democratic in character so as to enable any youth of good character to take advantage of it provided he has had a good primary and secondary education, and has reached the age of sixteen years. Two types of trainees are provided for, *viz*:—

(*a*) Engineering apprentices.
(*b*) Student apprentices.

The former are required to serve an apprenticeship extending over a period of five years in a manufacturing engineering works, whilst concurrently they are expected to attend evening classes at a technical school or college, so that at the end of the period they can pass the diploma or other equivalent examination.

The student apprentices would be those who had passed through a three years' day course at a technical college or university, and had taken an engineering degree or passed the diploma or equivalent examination. They would then be expected to serve an apprenticeship in a manufacturing engineering works for two years.

The authors of the report have laid great stress on the importance of the trainee's acquiring some practical experience in a manufacturing engineering works, as they do not consider that a power station is the most suitable place in which to give a youth a good mechanical training.

After finishing their respective periods in a works both types of apprentices, subject to their progress and attainments being satisfactory, would be drafted to an electricity undertaking to undergo there a further training for a period of two years.

During that time they would be given opportunities of acquiring experience in the various departments, such as the power station, mains, testing, &c. Records would be kept of their progress and abilities by the chief engineer or his assistants, and these would be available for the National Joint Board as soon as they had completed their training.

It may be explained at this juncture that the report recommends that general supervision over the working of the scheme should be exercised by the National Joint Board of the Electricity Supply Industry, and that it should keep a register of the youths who are undergoing training, and also a list of suitable undertakings to which trainees could be drafted. When a youth had completed his training, which it will be noted comprises a total period of seven years, he would be expected to pass the A.M.I.E.E. examination or an equivalent examination specially prescribed for supply engineers by the Institution in collaboration with the National Joint Board. If he was successful, and provided that his record was satisfactory, he would be entered upon the register of qualified electrical power engineers which would be kept by the National Joint Board.

The report also deals with the question of regulating

the supply of trainees so as to avoid undue congestion in the industry and also with the size of undertakings which are most suitable for providing training facilities. These are controversial questions and will doubtless require a good deal of discussion with the employers before finality is reached.

It should be noted that in advocating that an engineer should have some experience in a manufacturing works, the report coincides with the views of the President of the I.E.E., who expressed the opinion that "the most suitable general training of the officials should include not only technical instruction and practical experience in the supply industry, but also experience in one or more sections of the manufacturing industry."

It will probably be desirable to make whatever scheme is adopted flexible, so as not to exclude really capable and deserving men, but it must be rigid enough to keep out the charlatan and the dud. The compromise between the two extremes will no doubt be arrived at by experience.

One of the most important features of the E.P.E.A. scheme is the register of men who have satisfactorily completed the prescribed course. It is not intended that those whose names are not on the register should be excluded from practising, or that Supply Undertakings should be compelled to employ only those who are registered. The object of the register is to provide undertakings with a reservoir of suitable engineers for responsible positions.

An electrical undertaking will find it the better part of wisdom when selecting a candidate for a vacant position to prefer one whose name is on the register, and there is no doubt that in time as registration becomes more and more recognised as the *sine qua non* of competency, responsible positions will be filled practically exclusively from the register.

It may be asked what part will the Institution of Electrical Engineers play in such a scheme? The answer is that it will be the body primarily responsible for laying down the standard of competency. In fact, it is to be hoped that the Institution will collaborate with the National Joint Board for the purpose of prescribing a special test for engineers who wish to be recognised as qualified electrical power engineers. In other words, it is hoped that the I.E.E. will be responsible for setting the standard of scientific and technical attainment, whilst the National Joint Board will control the practical working of the scheme.

Here we are brought face to face with the question of the respective functions of a scientific institution like the I.E.E., and a protective organisation like the E.P.E.A. Both have their place in the structure of the electrical industry for both have the duty of safeguarding the interests of the electrical engineering profession. The one is concerned with the technique and scientific advancement, and the other with the economic interests of the profession. As long as the I.E.E. is constituted as at present there is one thing it cannot do for its members, namely, safeguard their economic interests, and such organisation as the E.P.E.A. and the S.T.E. are bound to exist for that purpose. The latter bodies can safeguard the professional interests of engineers in the various industries by ensuring that their attainments in technical skill and knowledge which the Institution exists to advance, receive their proper recognition and reward. There is therefore no reason why both types of organisation, namely, scientific and protective should not work in complete harmony.

In the writer's opinion the time will come when every employed technical engineer will consider it as necessary to his professional status to be in a protective association as to be in a scientific institution. By that time no doubt such organisations as the E.P.E.A. and the S.T.E. will have evolved from the trade-union stage which they have been compelled for the time being to occupy, and will have reached a higher professional level similar to that of doctors and lawyers, whose societies act in a protective as well as in a scientific capacity. This can only be achieved, however, when employers, electricity authorities, &c., have learned to give the engineer's service its due reward and to accept without question the decisions of the proper negotiating machinery.

It is a pity that the somewhat militant methods which such bodes as the E.P.E.A. have been obliged to adopt, owing to the reluctance of some employers to accept negotiated decisions, should have obscured the positive contribution that they can make towards the uplifting of the status of the profession. In such a matter as the training of engineers they can supply the motive force, and also assist in exercising the necessary supervision which will make a scheme of training both practicable and successful.

The Electrical Imports of Esthonia.

THE values and weights of electrical machinery and apparatus imported into Esthonia in 1923, according to the recently issued official statistics, are given below. For purposes of comparison, where possible, the weights for 1922 are also given, statistics of values for that year not being available.

	1922. Poods. (abt. 36 lb.)	1923. Poods.	1923. Thous. mks.*
Electrical machinery and apparatus—			
Grand Total ...	—	61,700	162,149
Dynamos and motors—			
Total	11,500	13,700	27,408
Inclu. from Sweden ...	460	1,400	2,743
,, ,, Germany ...	10,600	11,700	23,447
Transformers—			
Total	1,400	4,300	7,263
Inclu. from Sweden ...	—	1,100	1,896
,, ,, Germany ...	1,350	3,100	5,348
Machine parts—			
Total	—	21	29
Accumulators and batteries—			
Total	—	651	719
Inclu. from Germany ...	—	600	656
Meters (ampere, watt and volt)—			
Total	—	240	7,120
Inclu. from Germany ...	2,000	225	6,741
Other electric meters—			
Total	—	724	2,172
Inclu. from Germany ...	—	684	2,053
Rheostats, &c.—			
Total	—	748	757
Inclu. from Germany ...	—	590	600
Electric bells (all from Germany)	—	93	654
Armatures and electrical material not elsewhere specified—			
Total	—	18,900	30,213
Inclu. from Denmark ...	—	325	522
,, ,, Sweden ...	—	414	662
,, ,, Germany ...	—	17,950	28,718
Metallic filament lamps—			
Total	1,075†	695	6,947
Inclu. from Holland ...	—	103	1,028
,, ,, Germany ...	1,042	560	5,597
Insulated wire (all from Germany)	—	167	483
Do., covered with textiles—			
Total	—	4,714	19,800
Inclu. from Sweden ...	—	3,380	14,200
,, ,, Germany ...	—	1,250	5,242
Do., covered with rubber—			
Total	7,000	4,351	18,276
Inclu. from Germany ...	—	3,907	16,412
Cables, underground—			
Total	—	12,007	36,020
Inclu. from Great Britain...	—	683	2,050
,, ,, Sweden ...	—	589	1,767
,, ,, Germany ...	—	9,540	28,620
Telegraph and telephone apparatus—			
Total	136	285	3,458
Inclu. from Germany ...	—	225	2,061
,, ,, Great Britain	100	—	—

* 800 Esthonian marks = £1.

† Including carbon lamps.

Justifiable Small Power Plant.

By A. B. MALLINSON, M.I.E.E.

(*Abstract of Paper read before the* NORTH-WESTERN CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS *at Manchester.*)

THE object of this paper is to justify the use of the small power plant under suitable conditions. Such a plant is justifiable when it can produce the required power—whether mechanically or electrically used—after allowing for all charges, both operating and capital, more cheaply than it can be purchased from the available outside supply.

Water Power.—It is somewhat remarkable that the water power used to-day, apart from three or four hydro-electric developments, is probably not one quarter of that used, say, 50 years ago in the days of cheap coal. Small falls could be brought into use again if the work were done on the right lines. The layouts should be simple, with automatic or semi-automatic control, and it should be possible to utilise at frequent intervals the small falls along any river, and so avoid trouble with riparian rights, &c. In a paper on "Present Practice in the Automatic Operation of Hydro-Electric Stations" at the Annual Convention of the American Institute of Electrical Engineers at Chicago in June, 1924, Mr. R. J. Wensley mentioned these systems as being regularly in use:—

(*i*) Control by water level, a float switch being employed to start and stop at predetermined levels.

(*ii*) Control by system frequency (so that as the load comes on and the frequency drops, due to overloading of the running turbines, further turbines at other stations will start) is apt to be troublesome if several attempt to switch in at once, and is of no avail if any large station is in parallel on the network.

(*iii*) Remote control over a pilot wire is very effective when stations are not too far apart.

(*iv*) Supervision control over a telephone circuit is very largely used, enabling the distant operator to start and also get information with regard to head of water, gate opening, load, &c.

(*v*) Control by manual operation of switch in station is effective when the size of plant merits a man being in attendance (not constantly, but when called by telephone).

(*vi*) Control by manipulation of the a.c. line is occasionally used, the plant in the remote station being started by closing the switch in the man-operated station, an a.c. relay then running the plant up.

(*vii*) Control by time switch can be used where the supply is to works, &c., where the maximum load is known in advance.

In this country the power obtained will generally be of the order of a few hundred down to 20-30 h.p. and, once equipped, the cost of operation on automatic or semi-automatic lines would be low.

Wind Power.—Such plant, provided the battery is sufficiently large, and that there is, say, an oil-driven emergency set for use during calm periods, will provide a steady supply of only a few horse-power.

By-product to Heating.—Where steam has to be raised for process or other work, apart from power, there is the strongest possible case for the small power plant. Such conditions occur in paper mills, bleach and dye works, chemical works, sugar and other refineries, public institutions, hotels, laundries, &c.

The pressures at which the steam is required for the heating process varies from 5 to 60 lb. and the difference in fuel consumption in raising steam at, say, 160 or 180 lb./sq. in. in place of the used pressure is very small; for instance, the total heat in steam at 160 lb. is only 3 per cent. greater than at 20 lb./sq. in. Even with saturated steam used under favourable conditions the steam loss in passing through the power plant is only 5-6 per cent. per unit. In most cases the demand for heating steam is more than sufficient to supply all the power requirements of the factory. Under some conditions the margin is such than an appreciable outside supply could be given; a case in point is the sugar refinery at Glebe, recently put into operation with the Corporation supply.

Where the fluctuations of demand for heating steam are great, *e.g.*, for grass and wood digesters in paper mills, and bleaching keirs and dye houses in finishing works, the introduction of a heat accumulator is desirable. The Ruth accumulator has, during the past few years, been largely adopted on the Continent for this purpose. Where steam is required for direct heating, no oil must be used—a condition easily fulfilled by using either engines with no cylinder lubrication, or turbines. Superheated steam is generally avoided for heating, but for long pipe runs a little is advantageous to avoid undue pipe losses.

The author's paper on "Electric Driving in the Paper Mills on Heat-economy Lines"* covered such mills fairly fully. In the case of a British esparto mill, boiling 190-200 tons of grass per week, the total steam required at from 15 to 45 lb. per sq. in. is from 20,000 to 35,000 lb. per hour. The boiler pressure being 175 lb., a pass-out plant of 650 kW to supply the whole of the electricity needed in the mill is a sound proposition. The total capital outlay is £12,500 and the operating conditions are: 132 hours per week; 50 weeks per year; 350 kW average load; 2,000,000 kWh per year; power plant steam consumption, average extra over heating steam taken at 5 lb. per kW. The gross operating cost is £2,192 per annum, and the gross cost per kWh is 0.263d.

For a bleach and dye works near Manchester (two 150-kW back-pressure sets) the total capital cost is £6,050 and the operating conditions are: 48-hour week; 50 weeks per year; 360,000 kWh per annum; 10 per cent. of engine steam consumption, representing power production 8/1 evaporation = 265,625 lb. coal (118.5 tons); say, 120 tons. The gross operating costs are £1,133 per annum and the gross cost per kWh is 0.756d. (public supply—1.5d. to 0.875d.).

For a mental institution of 1,300 beds (three 75-kW back-pressure sets) the capital cost is £7,700 and the operating conditions are: 108-hour week; 52 weeks per year; 224,000 kWh per annum; engine steam, ½ lb. coal per kWh, all exhaust being used for heating = 50 tons of coal. The operating costs are £1,347 gross per year and the cost per kWh 1.45d. In this case an offer for a supply was 3½d. per kWh, the institution to provide the sub-station and equipment.

These three typical cases suffice to show the possibilities of such power plant to generate at an appreciably lower rate than that at which an outside supply can be obtained. They also show the limitations of such plant as regards capital expenditure. The paper mill with a 132-hour week obviously provides the best figure of gross cost per unit; with plant operating one or two shifts per day, the interest and depreciation item amounts to nearly double the generating cost. It is, therefore, of vital importance in installing such plant to employ the simplest layout and concentrate the capital cost as far as possible on the producing equipment; to make a central station in miniature simply means saddling the operating cost with an overwhelming charge. No capital or operating cost is given for steam-raising plant; the boilers are required for the production of steam for heating, whether the power plant is installed or not, and the extra 10 per cent. of fuel consumed will entail no extra labour, except under exceptional conditions with the steam plant already working up to its limit. The cost of pipework is high, all pipes being increased to pass the required volume at the lower pressure; in addition, the pipes cannot be too well covered.

Power from Process Refuse.—The principal sources in this country are woodworking establishments, tanneries, blast furnaces, coke ovens, steel works, &c. Whilst in the woodworking trades, refuse is utilised for power purposes to a considerable extent, there is a large quantity not effectively dealt with. In a city like Manchester there are about 100 woodworking establishments, producing probably 750-1,000 tons of refuse per week, whilst throughout the country it probably amounts to 100,000 tons or more. In a typical saw mill, case, and box works cutting up about 55 standards (137.5 tons) per week, the refuse produced during a week averaged 60,855 lb. (say, 27 tons or 19.6 per cent. of the total). At this works the power required is 100/120 kW.

In existing woodworking shops the layout is in general compactly grouped round the boiler and engine; to introduce a new power plant entails either putting it in a vacant space away from where the refuse is produced—entailing a material increase in the cost of handling the refuse—or shutting down the plant for a month or two while the old plant is dismantled and structural alterations are affected. In consequence, the owners usually take a public supply and scrap their engine, and are still faced with the problem of the disposal of the refuse.

In this respect much can be done by the adoption of a more broadminded attitude by the supply company. The author suggests that the ideal method is for works to adopt the electric drive, taking the public supply, and then to scrap the old power plant and install an upto-date wood refuse power plant in the central position. Then, when in operation, the public supply could be retained as a stand-by to whatever extent may be agreed upon, the consumer guaranteeing a certain minimum cost per annum. If, as will often be found to be the case, the power required exceeds that which the refuse can generate, a section of the works could be permanently connected to the outside supply.

Such power plant can be either steam with suitable combustion chambers, or gas with suction producers, the former requiring from 4 to 4½ lb. of refuse per b.h.p.-hour, and the latter from 2½ to 3½ lb. Whilst gas is the most economical on paper, the provision of steam for seasoning, heating, &c., and the class of refuse produced, must be taken into consideration. In the case of a typical city saw mill (steam plant fired with refuse in an underground step grate and 130-150-h.p. locomotive type tubular boiler) the capital outlay is £3,600 and the operating conditions are: 84-hour week; 50 weeks per year; town's water for boiler; 168,000 kWh generated per annum, the gross cost per annum being £845 and the cost per kWh 1.21d.

For a bobbin works (420-515-h.p. steam plant) the capital cost is £9,800; 275 kW steady average load; 660,000 kWh per

* *Journal* I.E.E., 1921, Vol. 59; p. 538.

year. The gross cost per annum is £1,645 and the cost per kWh 0.6d.

For a builder's saw mill and joinery works driven by a 160-h.p. wood-refuse gas plant the capital outlay is £3,800; 48-hour week; 50 weeks per year; 168,000 kWh per annum, the gross cost per year being £830 and the cost per kWh 1.19d. Plant of this character can very often be installed as a direct drive, which would reduce the capital cost by, say, £500. Refuse-gas plant is adaptable to a wide range of waste products available in this country, from wood refuse of all kinds to tannery refuse, barks, &c., and even stable manure.

Surplus Gas: Blast-furnaces, Coke Ovens, &c.—The utilisation of surplus gas for power purposes is now practically universal and in some areas, such as the North-East Coast, plant so operated feeds into the public supply networks. Until a few years ago, plant was generally gas-engine driven, but the later developments have in the main been by steam turbines fed from gas-fired boilers.

Household and Town Refuse.—Such plant may be small, but tends to national economy, and as such should receive every encouragement. The financial results could often be improved if steam were sold for heating in addition to the production of power. The difficulties caused by a fluctuation of the calorific value of refuse, &c., would be overcome by the installation of stand-by oil engines.

Self-contained Power Stations.—Whilst primarily this paper deals with the small power station fed with refuse, or steam as a by-product, there is, in the author's opinion, in many places at least a strongly debatable case to be made out for the self-contained small station. The capital outlay for super-power-stations, long transmission lines, sub-stations, and the like, is very large and must introduce a heavy charge on to the cost per unit in scattered areas with a low load factor. In a typical example with a steam-driven station of 2,500 h.p. capacity, the total generating cost per unit, including rates and taxes, is 1.0d. per unit, part of the plant being over 20 years old.

With the highly efficient steam or oil prime movers available to-day, these small stations show very favourable results. If a new super-power station and its network were to be compared with new small-power plant of the most efficient type, there would at least be a case for argument. The predominant factor is capital cost. There is no room for "frills"—miniature central stations, and the like—and nothing but bare necessities should be installed. In the same way the operating costs must be kept down.

Discussion at Manchester.

Mr. S. G. WATSON said he was in cordial agreement with many of Mr. Mallinson's remarks. There were undoubtedly many cases in this country where steam was going to waste, which could be used with advantage, particularly in the paper-making and wood-working trades; he was acquainted with a number of instances where wood-working machinery was entirely driven by gas produced from the waste wood. Waste material was utilised under extremely efficient conditions and no supply company could compete. In the estimates put forward no charge was made for buildings, boilers, or (in the majority of cases) for wages of operation. For the purpose of comparison the capital charges and expenses justly attributable to the work should be charged, which would make a great difference in the final cost per kWh. A larger allowance should be made for repairs, and rates taken into account. Plant installed in a works was a source of constant worry and trouble; therefore, manufacturers were glad to transfer to the shoulders of somebody else the responsibility for generating their supply. Many transfers to the public supply mains had been made for that reason. Electricity was being supplied at rates quite as low as, if not lower than, those Mr. Mallinson had arrived at.

He regretted that the supply undertakings did not always take up a reasonable attitude. Some two or three years ago a paper mill required from 200 to 300 additional h.p., which meant an output of from 1,000,000 to 2,500,000 kWh per year and the local authority quoted 1¼d. per kWh. At that time he was associated with an undertaking which was supplying at about 0.45d. More use ought to be made of the large number of small powers available from streams. The flow of the Irwell through Salford varied from 2 to 20 million gallons and when passing over weirs it had a head of from 6 to 8 ft. It should be possible to get from the river an appreciable output at extraordinarily low cost. In many cases the plant could be run automatically, and under certain conditions it was possible to get 4,000,000 or 5,000,000 kWh a year.

Mr. J. FRITH said he knew power supply companies that helped small plant to change over, acted as stand-by, and purchased surplus power. A small self-contained generating plant would often show a good financial comparison with purchased power; it avoided several large items of expense incurred by the big station. It was surprising that the water power now used in this country was only a quarter or a fifth of that used 40 or 50 years ago. Their forefathers seemed to have been extraordinarily alive to the possibilities in this respect, and so great a number of people had acquired vested riparian rights that he believed they were blocking the development of small power plant. The owners could be dispossessed by Act of Parliament, but the consulting engineer could not do it.

Mr. A. E. CLARKE cited the case of a flour mill wherein electricity was substituted for steam. At first electricity was more expensive, but when the machinery was increased and the output doubled, the results were quite satisfactory. The elastic quality of electricity gained the day. Each problem ought to be considered on its merits.

Mr. G. F. SILLS pointed out that Mr. Mallinson did not take into consideration the enormous advantage of having reserve plant as a stand-by. This was very unusual in private plant, but it was contrary to all ideas of national economy that a supply company should insist on the consumer taking all his power from it instead of using what he could produce himself. Under the new Act the Electricity Commissioners could decide questions regarding water rights. He had strong suspicions that work done in connection with private plant was often wasted, the object merely being to force the supply company to supply at a cheaper rate than it would otherwise agree to.

Mr. DUNDAS said that the examples quoted showed a good case for combining steam and electricity, but the costs were under-estimated. The paper mill was Mr. Mallinson's best case; there was sufficient steam to run the whole show and to get power for nothing, but it depended upon the coincidence of the two loads and as a rule they did not concur. A supply company should not be expected to provide stand-by plant unless a fixed charge was made to cover the capital cost.

Mr. W. J. MEDLYN said the author rather implied that he did not agree with the policy of the Electricity Commissioners, the basis of which was that large stations were to be preferred to a multiplicity of small ones. Formerly the Post Office had a number of small generating stations, in London and the principal provincial towns. They were mostly erected about 25 years ago, when a Corporation supply was more likely to break down than was the case now. It had since become a sound economic proposition to close those small stations and take a supply in bulk from the authorities. The valuable space such an arrangement made available was a matter of some importance.

Mr. G. A. JUHLIN thought it would be a great mistake to attempt to lay down rules and regulations as to whether power should be taken from a public supply or from one's own plant. Much could be said on both sides. Hydro-electric plant with its high capital cost was only justified where the coal charges were high. There were a number of cases where power could be produced considerably cheaper than the charge made by the supply authorities, but other things had to be considered. A private plant involved worry and trouble and some people wanted to transfer the responsibility to the engineer of the power company or municipal undertaking.

Mr. HERBERT remarked that large establishments which could generate their own power ought to do so if it conserved the national resources.

Mr. ROTHWELL did not see that any public institution could gain by taking electricity from a Corporation instead of producing it itself. He gave particulars of one such case within his knowledge.

Mr. AYLMER suggested that the engineers of the big combines which ran their own stations could give some interesting information bearing on this subject.

Mr. JUSTIN criticised the author's method of making comparative estimates.

Mr. W. A. CHRISTIANSON thought a case could be made out for the small plant where proper care was taken. Some people preferred to produce their own power in order to keep control of their business in view of the possibility of strikes and consequent dislocation.

Mr. CREWS said that in many cases it paid to have a private plant. Local conditions decided it. Such plant was of service for relieving the supply undertakings of their peak load and he had made many arrangements for alternative supply where the consumer undertook to avoid the peak load. There was a reason to criticise the manner in which the prospective consumer was approached by the supply companies. He was told the charge would be 0.3d. or 0.4d. per kWh. When he came to look into the matter he found there was a fixed sum and a coal clause, and so on; and the whole charge worked out at about 1.3d. Then he felt he had been deceived.

The CHAIRMAN (Mr. H. C. Lamb) said he did not know any public authority which would refuse to supply works except on the condition that they had the whole. In Manchester some firms had their own plant and also drew a supply from the Corporation, but for a stand-by a proper payment should be made. A large power station with high-pressure mains and distributing stations could supply at a lower cost than a small station, and in his opinion the multiplication of small power stations would be a retrograde step.

In his reply Mr. A. B. MALLINSON said he saw no reason for charging the cost of boilers where they were already installed for such a purpose as producing process steam. Why should anything be included for rates when one piece of machinery was replaced by another? The amounts for repairs were what had been actually paid. There was something in the suggestion that manufacturers wished to avoid the worry of looking after their own plant, but something could also be said on the other side. What about strikes? It was surprising how often the cycles of heating and power coincided fairly well. Notwithstanding the prejudice of insurance companies the heat accumulator was coming in this country, and it was making wonderful strides on the Continent. During the last two years there had been a great development in the use of automatic control gear for local sub-stations. That could be applied in the utilisation of water power. It was difficult to get figures from the big combines, and those he had were given to him in confidence, but he could say that figures based not on one plant but on a dozen, were much better than those given in the paper.

The Internal-Combustion Locomotive.

Electrical Transmission Gear.

By J. W. HOBSON.

(*Abstract of Paper read before the* NORTH-EAST COAST INSTITUTION OF ENGINEERS & SHIPBUILDERS *at Newcastle-on-Tyne.*)

ALTHOUGH the position of the steam locomotive on home main lines is as yet not seriously menaced, there are many applications in everyday railway service, even in this country, to which the internal-combustion locomotive can be advantageously adapted. In many countries where the cost of coal relative to oil fuel is greater than in this country the internal-combustion locomotive will undoubtedly be recognised as commercially superior to the steam locomotive, once its all-round reliability and efficiency are definitely established.

The earliest divergence from orthodox locomotive practice was the Heilmann steam-electric locomotive of 1893 which had an improved thermal efficiency as compared with the saturated-steam locomotive of that period.

The next notable attempt was the first application of the turbine in locomotive practice, *viz.*, the Reid-Ramsay steam-turbine condensing electric locomotive constructed by the North British Locomotive Co., Ltd., and subjected to trials in 1910. The Swiss Locomotive Works constructed a geared-turbine condensing locomotive for the Swiss Federal Railways in 1920, the turbine being of the Zoelly type developing 1,000 b.h.p. which can, however, be increased to 1,500 b.h.p. when required. A turbine of the Curtis type developing 700 b.h.p. is also incorporated for backward running. The drive is through double-reduction gearing to a jack shaft from which the wheels are driven by connecting rods. Economies of 25 per cent. in fuel consumption and about 50 per cent. in water consumption were effected. The locomotive constructed in 1921 by the Aktiebolaget Ljungström Anturbin near Stockholm is a striking departure from others of this class, having a non-reversing turbine and the interposition of an idle pinion between the pinion and wheel of the final drive for the purpose of reversal. The power is transmitted from a turbine rated to develop 1,800 b.h.p. through a double-reduction gearing to the driving wheels by means of connecting rods. Under actual working conditions, a net saving of 50 per cent. of fuel was obtained in addition to which additional tractive power for the same adhesion ratio, due to the more even torque on the axle, was available.

The Ramsay turbo-electric locomotive constructed by Armstrong Whitworth in 1923 is a development of the Reid-Ramsay locomotive, further study, however, having been given to the condensing arrangement. It is claimed that in spite of having the cooling water limited to 2,200 gallons a vacuum of 27½ in. is maintained. The primary power is 1,200 h.p. The latest development is the Reid-McLeod turbine condensing locomotive, reconstructed by the North British Locomotive Co. and exhibited at the British Empire Exhibition, 1924. Instead of electrical transmission, geared turbines are placed longitudinally actuating the driving wheels through double-reduction gearing. It is claimed that a saving of 50 per cent. in fuel will be effected, as compared with the ordinary non-condensing locomotives. The Krupp-Zoelly condensing turbo-locomotive, built to the order of the German State Railways and now undergoing trials, has two turbines, one forward and the other reverse on the same shaft across the front of the locomotive. The power is transmitted through reduction gearing to a jack shaft, and the forward turbine develops 2,000 b.h.p. A saving of from 20 to 30 per cent. in fuel consumption, as compared with the ordinary superheated-steam locomotive, is claimed. Undoubtedly the geared-turbine locomotive has greater possibilities, including saving of weight and lower first cost, as compared with the turbo-electric type.

Table I, based as far as possible on average results, shows that the greatest possibilities for increased thermal efficiency are in the application of the internal-combustion engine.

TABLE I.

Type of Locomotive.	Thermal Efficiency at rail.
Simple saturated	5 per cent.
Simple superheated	7 ,,
Compound superheated	8.5 ,,
Turbo condensing, with geared transmission	11.5 ,,
Turbo condensing, with electric transmission	9.6 ,,
Electric, assuming 12 per cent. power station efficiency	8.4 ,,
Direct-acting internal-combustion ...	32.5 ,,
Internal-combustion, having a transmission system	24 to 26 per cent.

The first real attempt to ascertain the possibilities of a large internal-combustion locomotive was that of Messrs. Sulzer Bros., who, after five years of experimental work, completed in August, 1912, their Diesel locomotive rated at 1,200 h.p. In 1910 the firm with which the author is associated, Messrs. R. and W. Hawthorn Leslie & Co., Ltd., began to receive inquiries from abroad for locomotives having some form of internal-combustion engine as primary power, chiefly from countries where the fuel and feed-water questions were acute. It was decided not to proceed with the development of the direct-acting locomotive, but to concentrate on the development of mechanical transmission for the smaller units and electrical transmission for powers approaching those met with in main-line practice.

Electric transmission is regarded by several well-known railway and consulting engineers as the most promising form applicable to the internal-combustion locomotive. With this system the speed of the prime mover is entirely independent of the speed of the locomotive and can thus always be run at the most efficient speed for the required output. The full torque may be transmitted for starting purposes and a high reduction ratio can be easily obtained. The driving motors may be arranged in a variety of ways and, if required, each axle may be separately driven. The transmission efficiency is from 75 to 80 per cent., except at starting when it is lower.

Electrical transmission is much used on the Continent, especially for units of the rail-car type, a considerable number of which are in use in Sweden and have given highly satisfactory results. About 20 Deva rail-cars made by the Diesel-Elektriska Vagn-Aktiebolaget are in regular traffic in that country, Denmark, and North Africa, the oldest having been in continuous service for 12 years; ample experience has therefore been gained regarding their safety, reliability, running costs, &c. In Sweden the total running cost is only about one-fifth of that of the steam trains formerly used on this service. Another type of rail-car is that constructed by Sulzer Bros. in conjunction with Brown, Boveri & Co., in 1922, which has given such satisfactory results that further cars of the same type have been recently built. The main engine is of 200 h.p. at 440 r.p.m., and the main generator is an eight-pole machine having an output of 140 kW at 300 volts. Separate excitation is provided by a 7½-kW six-pole dynamo, the excitation of which is provided by accumulators. The latter also supply the power for starting the main engine, the generator being used as a motor during this period. The driving motors are six-pole machines with six interpoles having series windings and the control is on the Ward Leonard system. The driving motors are geared to a central jack shaft which operates through coupling rods both axles of the motor bogie. An electrical transmission appears to be the most convenient form for rail-car and trailer working as it permits of control from remote points with wired connections only; hence the necessary arrangements for dual control can be of the simplest character.

An interesting example of a main-line internal-combustion locomotive embodying electrical transmission is the Lomonossoff locomotive completed a few months ago at the Esslingen Works, Stuttgart, for the Russian Government. It is of the 2-10-2 type with coupled wheels, 4 ft. diameter, fixed wheel-base 18 ft. 9½ in., overall length over buffers 45 ft. 4 3/16 in. The prime mover is a M.A.N. six-cylinder four-stroke Diesel engine with cylinders 450 mm. (17.717 in.) diameter by 420 mm. (16.535 in. stroke); h.p. 1,200 at 450 r.p.m. A generator supplies d.c. to five motors each geared to its respective driving axle by a 6.14 to 1 reduction gear. The maximum designed speed of the locomotive is 31 m.p.h. and the tractive power is stated to be 15 tons. The weight of locomotive empty is 116 tons; fuel capacity 4 tons; water, lubricating oil, &c., 4½ tons. The weight of the complete locomotive in working order is 125 tons, of which 95 tons are available for adhesion.

Electric transmission has many excellent qualities to recommend it and in many respects can be considered technically the best system (particularly when an orthodox internal-combustion engine is employed). By its use decided economies can be effected in operation on occasional steep gradients on an otherwise level line—the expense of piloting trains and maintaining banking engines, &c., for the grade working can be avoided by electrifying the track on the grade only. In such cases the internal-combustion electric locomotive need only be provided with a prime mover of sufficient power to meet all normal demands and the additional power required on the grade could be drawn from the overhead line or third rail. This arrangement would enable the scheduled speed on the grades to be considerably increased and would be less costly than complete electrification.

In the Diesel-electric locomotive, the transmission can be assumed to give a mean efficiency of 75 per cent. with a maximum of 83 per cent.; thus, the h.p. available at the wheels is from 900 to 960. As a comparison the L. & N.E.R. 0-8-0 3-cylinder goods locomotive (which, on test, has proved capable of maintaining 1,000 h.p. for short periods) in working order with its tender weighs approximately 115½ tons, as against 125 tons of the former; but as regards light weight the difference in favour of the steam locomotive with tender is 30 tons,

which is material to be paid for, entailing a serious handicap for the internal-combustion electric locomotive.

In 1902 Captain W. P. Durtnall first proposed his thermo-electric locomotive, but it was not until 1920 that an experimental standard-gauge locomotive having this type of electric transmission, and embodying some unusual features, was put in hand, and valuable research work has been carried out. Being purely experimental, new internal-combustion engines were not used; they are of the six-cylinder straight-line type and (as at present arranged) develop 160 b.h.p. each at 450 r.p.m. Between them is mounted a separately excited six-pole direct-current generator, with interpoles, of 220 kW capacity at 440 volts, which supplies four motors, each of 68 b.h.p. when running at 1,200 r.p.m., mounted longitudinally at each end of the two bogies and each transmits its power through flexible couplings and a cardan shaft to a single-reduction worm gearing having a ratio of 7.33 : 1 mounted on the axle of the remote pair of driving wheels. The locomotive is of the double-bogie type, all wheels being 3 ft. diameter. An auxiliary engine embodies an air compressor supplying power for the brakes and is directly coupled to a small d.c. generator across which floats a battery for exciting the main generator, starting the main and auxiliary engines, lighting, &c.

The locomotive can be controlled from either end by master controllers, the equipment being designed to control 4 motors in series, 2 sets of motors in series-parallel, 4 motors in parallel and for top speed up to 25 m.p.h. by diverter resistance field weakening, no main resistance being employed. The efficiencies of the following various components on test were as follows:—Generator, 93 per cent.; motor, 92 per cent.; worm gear, 96 per cent.; which gives a theoretical overall transmission efficiency of 82 per cent. The locomotive has a total weight of 43 tons in working order.

The electrical equipment was designed for a maximum draw-bar pull of 6 tons and on test this was exceeded. The locomotive was tested on the works railway, which includes a grade of 1 in 14 on the straight and grades of 1 in 18 combined with an S curve. The performance of the whole of the transmission equipment has always been highly satisfactory and the only trouble experienced has been with the petrol engines which were, as previously mentioned, not altogether suitable for the strenuous conditions of locomotive service. The transmission having passed all the tests in an exceedingly satisfactory manner, the locomotive has been sent back to the shops to have the temporary petrol engines removed and, with the substitution of a suitable internal-combustion engine, can be expected to emerge as a thoroughly reliable, high-class, shunting locomotive.

In all orthodox types of electrical transmission considerable losses are inevitable in resistances, and regeneration is not practicable on account of the varying voltage at which such energy is delivered. These difficulties may be overcome by the adoption of Captain Durtnall's Paragon B. & B. system which has a transformer in the transmission system and employs accumulators for storing the regenerated energy. The engine can then operate at all times at constant load and speed; the transformer-generator and traction motors have separately excited field windings supplied from a storage battery. Speed control is effected by variation of the voltage supplied to the motors from the transformer-generator so that there are no resistances in the main circuit. At stopping and when descending steep gradients, the current regenerated by the traction motors is returned to the transformer which transforms it to the required voltage for return to the battery.

The disadvantages of this system are inherent in the battery; the possibilities are, however, admitted and it has much to recommend it under favourable conditions, such as mountain grade operation or for short rapid shunts where substantial economies can be effected by regeneration. It has been applied with success to a battery locomotive built by Messrs. R. & W. Hawthorn Leslie & Co., Ltd., exhibited at the British Empire Exhibition, Wembley.*

Amongst other transmission systems the Thomas combined mechanical and electrical system, which is successfully employed in small powers, utilises epicyclic gearing with an electric generator and motor. It is claimed that this combination of mechanical and electrical transmission is cheaper and lighter than the full electrical method, but in the author's opinion it is more complicated and likely to lead to increased maintenance cost.

The initial cost of a new departure should not be unduly compared with the developed and practically standardised steam locomotive. The importance of first cost is not, however, ignored by the advocates of the internal-combustion locomotive and it is up to internal-combustion and electrical engineers and other specialists involved in its development to make themselves acquainted with the requirements, scope, and restrictions of railway transport. Not only is the light weight of the internal-combustion electric locomotive considerably in excess of that of a steam locomotive of corresponding power, but this excess consists of more expensive material and workmanship. In this connection a very fair basis of respective costs is given in a book entitled "Uber Diesel-Elektrische Lokomotiven im Vollbahnbetrieb," by Dr. Herbert Brown, who gives the base cost per ton for the Diesel-electric locomotive as 1.783 times that of a steam locomotive and tender of equal capacity having a superheater and feed-water heater. This figure is slightly under that which the author has been accustomed to consider correct, but it must be conceded that more manufacturing has been done on the Continent than in this country in this direction and consequently costs have been reduced. In this country the manufacturing cost ratio at present is in the region of 1.9 for Diesel-electric and 1.48 if hydraulic transmission is employed. In any case, the cost of electrifying the suburban railways in one of the largest European capitals has caused the suspension of the scheme until the merits of the internal-combustion locomotive have been thoroughly investigated.

The demand, particularly from abroad, for a suitable internal-combustion locomotive is now apparent, and as the pioneer of the steam locomotive this country cannot afford to allow Continental competitors to be the only source of supply. German State Railway engineers have openly stated their conviction that the internal-combustion locomotive is the hauling agent of the future and whilst they are reluctantly continuing to use the steam locomotive (which they consider cannot be much further improved) as a stop-gap, in the meanwhile they are strenuously concentrating their attention on the development of the former.

* ELEC. REV., September 26th, 1924; p. 459.

The Institution of Electrical Engineers.

Annual Dinner.

THE annual dinner of the Institution of Electrical Engineers was held at the Hotel Cecil on February 12th. Mr. W. B. Woodhouse (president) occupied the chair and was supported by members of Council; covers were laid for 522—a record attendance—and the many distinguished guests included some of H.M. Ministers and Electricity Commissioners, Colonial High Commissioners and Agents General, representatives of the fighting services, Government departments, the law, engineering and scientific societies, &c.

Following the loyal toasts, the "Institution of Electrical Engineers" was proposed by Sir ARTHUR STEEL-MAITLAND (Minister of Labour), who said it was superfluous to propose the Institution's health as its vitality was shown by its membership, but there was greater significance in its growth. Unemployment in the electrical industry was less by far than one half what it was in other engineering trades and less by half than in other insured industries. Exports in the electrical industry were expanding not rapidly but steadily, and the industry at home was growing in volume, though he wished that they supplied all home requirements without the country having recourse to supplies from abroad. To-day it was the one industry in which there had been a great and quite inevitable growth, and to his mind it was to the expansion in electricity—both in itself and in the facilities it could provide other industries in the cities and in the country—that they had to look for much of the improvement in the conditions which existed in England and Scotland to-day. It was absolutely vital to keep abreast of America, Germany, and other countries in technique and organisation, and the broadminded view of things must be taken.

The PRESIDENT, in responding, remarked that the growth of the I.E.E. was an indication of the importance of electrical science in civilisation. They were living in an age of extraordinary scientific development—it was suggested that electricity was even more fundamental than matter. They sold what all the world desired—power—and in the manufacturing field electrical engineers, in a time of national trade depression, had, relatively speaking, been prosperous as compared with the general engineering trades. The electricity supply industry, although suffering much from legislation, was still booming. It would continue to do so if given a fair field. There was considerable public misunderstanding regarding the progress that had been made in this country, both during and since the war. Only that day he saw a statement in a newspaper that the average price of electricity in this country was 5d. per kWh; that was erroneous, as the average price at which the great power companies sold electricity was less than 1d. per kWh and municipalities, despite the larger proportion of lighting they had to deal with, sold electricity at an average price only slightly higher than that figure. It only required a continuation of the present growth and development of demand for one to see that in a few years this price would be substantially reduced. To attain that end the industry required freedom from disturbance, or at least if any change was proposed an assurance that the views of the industry would be taken before any final plans were made.

Sir JOHN SNELL (Chairman, Electricity Commission), in toasting "Our Guests," referred to the Gilbertian situation regarding the relations of the Commissioners and the Minister of Transport, remarking that were it not for the interest and sympathy shown by the Minister he did not know what would happen. That morning he was intrigued when he saw a newspaper poster and when he had read the article he thought to himself there was nothing more to be said on the matter—they had reached the era of a "cheap and abundant supply."

Lt.-Col. WILFRID ASHLEY (Minister of Transport), in the course of his reply, said that the situation was truly Gilbertian, but the English nation was a practical nation and common-

sense had enabled them to work harmoniously. In a matter which must affect so deeply the industrial and commercial life of the country, and the home life and amenities of the people, if they went slowly and investigated and took advice from all they would be much more likely to evolve a sound system than if they hastily developed some scheme merely for the sake of launching a scheme. He did not know on what ground those statements were made which appeared quite often in the public Press as to the intentions of the Government with regard to electrical development, because they had only reached the stage of investigation. Until they had fully explored every avenue and had consulted, so far as they were able, every source from which they were most likely to obtain useful advice, it would be premature for the Government to come to any conclusion. In electricity they had something which would regenerate the country.

Mr. W. B. WOODHOUSE (chairman) then read messages of greeting from the Société Française des Electriciens and the Associazione Elettrotecnica Italiana, after which Sir JOSEPH COOK (High Commissioner for the Commonwealth of Australia), also responded to the toast.

After dinner a reunion took place in the Victoria Hall, and the programme of music rendered by the British Imperial Orchestra contributed to the success of the evening.

United States Foreign Trade, 1924.

THE trend of the foreign electrical trade of the United States last year may be gauged from a survey just made by the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce at Washington. Subject to the issue of final figures for December it is estimated that the value of electrical exports in 1924 totalled $85,000,000, an increase of about $12,000,000 over the 1923 total. Even this large total does not include the electrical equipment embodied in motor-cars or the built-in motors of machine tools.

Whilst there was a decrease in the shipments of the larger capacities of a.c. generators, this falling off was more than counter-balanced by gains in those of d.c. dynamos and of a.c. generators under 2,000 kVA. A feature in the motor business was a large increase in the exports of railway types. There was also a considerable advance in the motor-generator section. An upward movement in the foreign sales of distribution transformers is attributed to Japanese orders to replace apparatus destroyed in the earthquake. There was a decline in the shipments of electric railway locomotives, but a compensatory advance in mining and industrial locomotives. The trade in self-contained lighting outfits continued its steady progress.

Radio apparatus again showed a remarkable increase, exports last year being estimated at more than $5,000,000, or virtually double those of 1923. A large gain (45 per cent.) was also shown in the sales abroad of electric fans, and an advance, too, in those of heating and cooking devices, whilst electrically-driven household appliances showed a small increase.

Canada remained the chief purchaser whilst South America receded from third to fourth place, Brazil being first amongst that group, Argentina second and Chile third. The Cuban market continued to grow, whilst Mexico took electrical goods to the value of $2,673,000 during the first six months of 1924, compared with $1,902,000 in the corresponding period of 1923. In Asiatic markets Japan was America's leading customer, Chinese trade having been adversely affected by political uncertainty. An increase in Indian business is attributed partly to the Government's recently-adopted policy of making purchases from importers and dealers in India. Amongst European buyers Great Britain retained the lead. The bulk of exports to Australia consisted of telephone equipment, motors and household appliances, and to New Zealand line material. There was a substantial increase of United States electrical exports to British South Africa in 1924.

Advantages of Strong Home Market.

The Electrical Equipment Division considers it noteworthy that despite a very strong domestic (*i.e.*, home) demand which "often causes a producer to slight his foreign market," American electrical manufacturers should have shown so great an interest in export trade. There is, however, another aspect of this matter, *viz.*, that unless production were in its initial stages promoted and fostered by home demand, it would not attain to the magnitude of an export industry and, further, that the greater the home demand the better chance the manufacturer has of spreading his on-costs and quoting competitive prices in foreign trade.

In this connection it is of interest to study an informative survey of the striking growth in the domestic use of electricity in the United States which appears in the current issue of *Commerce Monthly*, the organ of the National Bank of Commerce in New York. The average American home is often depicted as replete with every kind of electrically-driven labour-saving device, but it is not generally realised that three-fourths of the residential users of current own electric irons, 44 per cent. vacuum cleaners, 33 per cent. fans, 29 per cent. electric washing machines, 13 per cent. heaters, 12 per cent. toasters, and 5 per cent. electrically-driven sewing machines and percolators. This does not exhaust the list of electrically-driven domestic appliances in common use. The rates of course vary, being lowest west of the "Rockies," where 85 per cent. of all the cooking ranges are to be found; elsewhere they are too dear for wide employment. American rates generally seem to be on a sufficiently low level to encourage consumption for many domestic purposes.

The United States, it may be said, has a more acute domestic-servant problem than this country. Whilst the population of the United States was increasing 15 per cent., the number of domestic servants, already relatively low, was decreased by 25 per cent. The labour-saving electrical appliance helped to fill the need thus created.

The Lighting of Llandaff Cathedral.

AN interesting electric lighting installation, which is remarkably in keeping with the architecture and character of the building, has recently been carried out in Llandaff Cathedral, Glamorgan. The installation consists of groups of three Holophane reflector-refractor units mounted on specially designed metalwork, each fitting taking a 150-W gasfilled lamp. They are spaced in two rows down the cathedral (fig. 1;

Fig. 1.—The Lighting of Llandaff Cathedral.

the rows are 35 ft. apart, and the fittings are placed at 16-ft. intervals at a height of 16 ft., which gives an illumination varying between 3½ and 7 foot-candles. By this arrangement the whole of the body of the cathedral is uniformly illuminated, and an entire absence of glare is obtained.

A similar arrangement of these reflectors in the chancel (fig. 2) produces a higher illumination, which shows up very well the altar and the magnificent reredos. The illumination

Fig. 2.—The Chancel and High Altar.

here rises to a maximum of 9 foot-candles, while on the Bishop's desk, choir stalls and lectern, it is an average of 6 foot-candles.

In the Lady Chapel there is a novel arrangement of six two-light standards. These standards are approximately 10 ft. high, and each carries two Holophane reflector-refractor units

containing 100-W gasfilled lamps. This arrangement lights up the whole chapel to a very high degree. The chapter-house is lit in a similar way, but to a lower intensity, except round the sides of the room, where the light is concentrated on the bookcases.

Llandaff Cathedral, which was restored in the early years of last century, is one of the oldest cathedrals in the country, and this installation harmonises very well with the character of the building. The work has been carried out by Messrs. Haddrill, Hutchison & Co., and the consulting engineers were Messrs. Angus Watson & Partners, Cardiff. All the material was supplied by the Siemens & English Electric Lamp Co., Ltd.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Diffusing Lamp Shade.

The "Uranus" lamp fitting, of French manufacture and somewhat unique design, is now on sale in this country, and the sole agent for the British Isles and the Colonies is Mr. B. T. MONIER-WILLIAMS, 214 to 222, St. John Street, Clerkenwell, E.C.1. It will be noted that the shade is made in two parts. The reflecting or upper portion of the shade consists of three layers of glass, one crystal, one opal and one clear, and is designed with a view to obtaining the greatest deflection compatible with economy, and from the section shown in fig. 1 it will be seen that the angles are so arranged that the reflected rays of light are directed from the horizontal to the desired vertical direction; it is claimed that no "secondary illumination" is necessary, a considerable amount of light being

Figs. 1 & 2.—Section of Shade showing Reflection of Light, and details of Interior Construction.

Fig. 3.—General View of Fitting.

directed upwards. The bottom or inverted portion, of frosted glass bowl and clear glass outer ring, is held in a metal band, suspended from the upper portion of the shade. The gallery, it will also be seen, holds the shade without the screws having any contact with the glass, allowing for expansion. Briefly the feature of the shade is a concentration of light by the upper portion, the lower portion destroying the glare or eye-strain effects.

A general view of the complete fitting is shown in fig. 3, while fig. 2 shows the construction of the gallery, &c. It should be noted that to obtain the results for which the fitting is designed, the lamp should be adjusted so that the filament is in the centre of the fitting as shown by the dotted line in fig. 1.

Repair of Chimney Stacks.

The *Electrical World* describes a simple but somewhat ingenious device adopted by the DAYTON POWER & LIGHT CO. This is a permanent rail and carriage around the top of its stacks. Much time and money is spent on erecting temporary structures to support carriers when commencing repair and renovating operations, and the installation of a permanent rail of this description should effect a considerable saving in this direction. The rail consists of ½-in. by 8-in. steel plate encircling the top of the stack, and supported by an angle iron which is riveted to the top of the stack. The carriage runs round the rail, and is kept in position by means of four rollers, two at the top and two at the bottom.

The "Banquo" Interlocked Switch and Plug.

We have received from MESSRS. WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester, a sample of their "Banquo" combined interlocked switch and plug, together with an "Izolex" replacement fuse. The switch is contained in an elliptical cast-iron box tapped at top and bottom for ¾-in. conduit. It is of the tumbler pattern, the dolly being

Fig. 4.—The "Banquo" Plug and Switch.

operated by a fork mounted on a spindle, which, passing through the cover of the box, bears the actuating lever on its outer end. Ample space is allowed in the box for the wiring of the socket terminals to the switch. The plug contacts at the front are sunk deeply and covered with an insulating bush. The three-pin plug has a screwed flanged

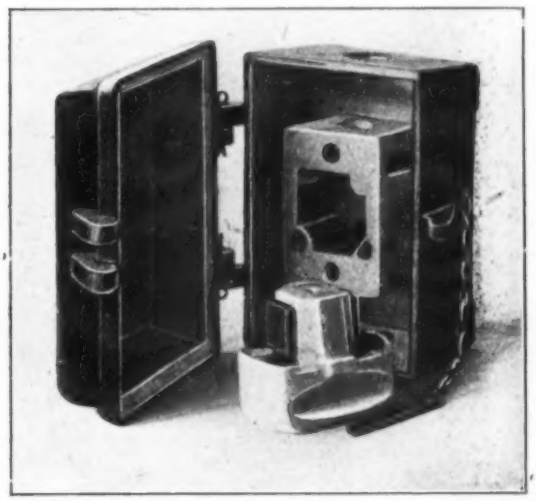


Fig. 5.—The "Izolex" Fuse.

collar which, fitting over a screwed boss on the front cover, retains the plug in position. The operating lever has an extension which, when the lever is in the "on" position, closes over the flange of the collar and prevents the plug from being withdrawn. The plug has a rubber entry bush, and is well finished in nickel plate. A screwed cap is provided to cover the contact sockets when the plug is out of use. The containing box is finished with black enamel. Fig. 4

shows the box with plug and lid removed; and the plug and lid.

The "Izolex" fuse is contained in a rectangular box, which can be connected to the plug box by a length of conduit, making a self-contained equipment. The base of the fuse is a substantial piece of porcelain with a square well, on two opposite sides of which are mounted copper tongues. The fuse bridge is in the nature of a plug with spring contacts to correspond with the tongues in the base. The plug portion of the bridge has a diagonal hole through it, enabling a long break to be provided in a small space. Fig. 5 presents a view of the interior of the box, and the fuse bridge.

Parliamentary.

(By Our Special Parliamentary Reporter.)

L. & N.E.R. Electrification.—On February 10th (on which day Parliament reassembled), Mr. R. MORRISON asked the Minister of Transport whether he had any information as to when the London and North-Eastern Railway Co. intended to commence the electrification of the suburban line northwards from Finsbury Park.

Colonel ASHLEY said he was informed by the railway company that the question was still under consideration, but that no decision had yet been reached.

Oil from Coal.—On February 10th COLONEL LANE-FOX, Secretary for Mines, informed Viscount Sandon that considerable quantities of tar oil, creosote, &c., were extracted from coal incidentally to the manufacture of gas and coke by processes of high temperature carbonisation. But the noble lord possibly had in mind the extraction of oil from coal by processes of low temperature carbonisation. Such processes were not at present operated on any large scale, and consequently the quantity of oil extracted by them was negligible. Considerable advance had, however, been made in recent years on an experimental plane, and he hoped that in time one or more processes might be established on a firm commercial basis. H.M. Government had for some years past been conducting experiments at the Government Fuel Research Station and publishing the results, and private investigators were being assisted.

Trade with Russia.—On February 10th SIR P. CUNLIFFE-LISTER, President of the Board of Trade, informed Mr. H. Williams that the following table showed the declared value of merchandise imported into, and exported from, Great Britain and Northern Ireland in 1924 registered as consigned from or to Soviet Russia and other states specified:—

Country.	Imports. £	Exports. £	Re-exports. £
Russia	19,994,329	3,820,708	7,357,744
Finland	13,811,715	4,558,533	1,021,930
Esthonia	2,464,671	627,965	236,021
Latvia	6,374,466	2,210,446	222,048
Lithuania	735,187	314,754	23,294
Poland (including Dantzig)	8,386,610	3,498,988	1,507,063

Census of Production.—On February 10th SIR P. CUNLIFFE-LISTER informed Mr. Hannon that he was not in a position to give an approximate date for the issue of the report on the Census of Production. He hoped that some preliminary figures for individual trades might begin to be available about the end of the present year. Much would depend upon the promptitude with which manufacturers and others furnished their returns. It was proposed to include in the report comparative statistics for 1912 whenever possible.

"Beam" Stations.—On February 10th, in reply to Sir H. BRITTAIN, who asked whether the sites for the Canadian and South African "beam" stations had yet been secured, SIR W. MITCHELL-THOMSON, Postmaster-General, said that sites for these stations had been selected and terms of purchase agreed. It was hoped that the legal arrangements for the purchase of the various properties concerned would be sufficiently advanced to enable the sites to be placed at the disposal of the contractors before the end of the present month. The sites were near Bodmin and near Bridgwater.

Private Bills.—It has been decided that the following private Bills, among others, shall originate in the House of Lords:—Bedfordshire, Cambridgeshire and Huntingdonshire Electricity; Horley District Gas Company (Electricity Supply); London and North-Eastern Railway (General Powers); London and North-Eastern Railway (Nottingham and Retford Railway); London, Midland and Scottish Railway; South Wales Electrical Power Distribution Company; and Uckfield Gas and Electricity.

Wireless Bill.—On February 11th Sir Wm. Mitchell-Thomson, the Postmaster-General, introduced a Bill "to re-enact and amend the law relating to wireless telegraphy, and to make provision with respect to visual and sound signalling and the use of etheric waves for the transmission of energy." The Bill was read a first time.

Government's Electricity Scheme.—On February 11th Mr. R. MORRISON asked whether the Government had yet come to a decision with regard to the electricity proposals of the last Government; and whether it proposed to introduce legislation to restore the compulsory powers of the Electricity Commissioners.

Colonel ASHLEY said that the programme adumbrated by Mr. Snowden was receiving the technical examination authorised by his predecessor which was a necessary preliminary to any decision. A review of the general position was also proceeding in which, among other points, the powers of the Electricity Commissioners were being considered.

London Electricity Supply Bills.—The London Electricity Supply Bills (Nos. 1 and 2), the County of London E.S. Co. Bill, and the North Metropolitan E.P.S. Co. Bill were further postponed on February 12th, and were ordered to be put down for second reading on February 19th (yesterday).

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

12,483. "Wireless-controlled aircraft." E. A. Sperry. July 9th, 1923. (227,489.)

23,377. "Arrangements for operating electrical apparatus." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. September 18th, 1923. (227,887.)

23,378. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., R. Mercer, and F. Tench. September 18th, 1923. (227,888.)

26,340. "Method of, and means for securing insulated parts of electrical apparatus together." British Thomson-Houston Co., Ltd., and E. B. Tuppen. October 22nd, 1923. (227,905.)

26,464. "Protective apparatus for alternating-current systems." British Thomson-Houston Co., Ltd., and A. S. Fitzgerald. October 23rd, 1923. (227,910.)

26,547. "Electric cooking apparatus." W. Service. October 24th, 1923. (227,913.)

26,586. "Dynamo-electric machines." Tilling-Stevens Motors, Ltd., and H. K. Whitehorn. October 24th, 1923. (227,917.)

26,615. "Means for obtaining rectilinear motion from the rotation of a shaft, especially applicable for actuating the sliding contacts of electrical instruments." T. Cox. October 24th, 1923. (227,919.)

26,799. "Electric fuses." A. Reyrolle & Co., Ltd., and F. Coates. October 26th, 1923. (227,928.)

26,800. "Electric synchroscopes and synchronising apparatus." A. Reyrolle & Co., Ltd., and P. F. Harris. October 26th, 1923. (227,929.)

26,830. "Electric protective arrangements." A. Reyrolle & Co., Ltd., and B. H. Leeson. October 26th, 1923. (227,930.)

26,837. "Circuit arrangements for selectors in automatic telephone systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. October 26th, 1923. (227,931.)

26,849. "Electrical condensers." E. H. Trump. October 26th, 1923. (227,933.)

27,096. "Bayonet-joint connections especially for holders for wireless valves, electric lamps, and the like." G. Barber and T. Hough. October 30th, 1923. (227,943.)

27,661. "Electric fuses." Electrical Improvements, Ltd., and G. L. Porter. November 3rd, 1923. (227,948.)

27,938. "Dynamo-electric machines." J. A. Kuyser and Metropolitan-Vickers Electrical Co., Ltd. November 6th, 1923. (227,953.)

29,047. "Actuating electric switches in connection with internal-combustion engines." G. Bowman. November 17th, 1923. (Cognate application 30,159/23.) (227,962.)

29,532. "Quick-make and quick-break electrical switches." W. McGeoch and I. H. Macqueen. November 23rd, 1923. (227,964.)

32,079. "Electric motor vehicles." N. E. North, A. J. Whittall, and Metropolitan-Vickers Electrical Co., Ltd. December 21st, 1923. (227,982.)

1924.

825. "Electric inductance coils." E. M. Eadie. January 11th, 1924. (227,995.)

1,055. "Electric lamp filaments." W. S. Pekovich. January 14th, 1924. (227,998.)

1,654. "Terminal ends for electric wires and cables." R. D. Boyce. January 21st, 1924. (228,001.)

1,871. "Electric time fuses for blasting." L. Lisse and W. Eschbach. January 23rd, 1924. (228,003.)

2,060. "Variable electric condensers." J. R. Spink and J. B. Langley. January 25th, 1924. (228,006.)

2,609. "Alternating-current generators." F. Contell. January 31st, 1924. (228,008.)

2,955. "Thermionic valve holder." J. R. Hoult. February 5th, 1924. (228,014.)

4,224. "Method of protection against the damaging effects of atmospheric electricity through local ionisation." A. Artom. October 2nd, 1924. (Convention date not granted.) (216,837.)

8,455. "Excessive voltage leak for high-voltage installations." E. Pfiffer. April 3rd, 1923. (213,917.)

8,636. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). April 5th, 1924. (228,037.)

11,658. "Electric switches." J. H. Steele. May 12th, 1924. (228,049.)

13,889. "Electrical motor-generator sets." Metropolitan-Vickers Electrical Co., Ltd. June 14th, 1923. (217,583.)

14,849. "Electric junction boxes." E. Grierson and J. W. Grierson. June 19th, 1924. (Addition to 208,432.) (228,060.)

18,036. "Collecting electrodes for use in the electrical precipitation of suspended particles from gaseous fluids." Lodge Cottrell, Ltd. (Metallbank und Metallurgische Ges. Akt. Ges.). July 28th, 1924. (228,073.)

18,458. "Electric contact." H. H. Berry. August 1st, 1924. (228,074.)